DEPARTMENT OF MINES AND AGRICULTURE.

MEMOIRS OF THE GEOLOGICAL SURVEY OF NEW SOUTH WALES.

E. F. PITTMAN, A.R.S.M., UNDER SECRETARY AND GOVERNMENT GEOLOGIST.

PALÆONTOLOGY, No. 13.

A MONOGRAPH

OF THE

SILURIAN AND DEVONIAN CORALS OF NEW SOUTH WALES;

WITH

ILLUSTRATIONS FROM OTHER PARTS OF AUSTRALIA.

PART I.—THE GENUS HALYSITES.

BY

R. ETHERIDGE, JUNR., J.P.,
CURATOR OF THE AUSTRALIAN MUSEUM, SYDNEY.

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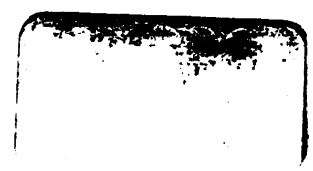

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Geological Survey Branch,
Department of Mines and Agriculture,
29th November, 1904.

Sir,

I have the honour to submit for publication Part I of Monograph No. 13 (Palæontology Series) on the *Silurian and Devonian Corals of New South Wales*, by Mr. Robert Etheridge, Junior, Curator of the Australian Museum.

Hitherto great difficulty has been experienced in our attempts to establish a dividing line between the Upper Silurian and Devonian rocks of New South Wales, so much so that it has been found necessary to make use of the term *Siluro-Devonian* to describe those rocks near the junction between the two formations, and which were regarded by the late Mr. C. S. Wilkinson, Geological Surveyor-in-Charge, as *Passage beds*.

Obviously the first thing to do in order to clear up this difficult question is to have as complete a description as possible of the fossil forms occurring in the Silurian and in the Devonian formations respectively. The information thus made available will, it is hoped, enable the dividing line to be definitely fixed without much difficulty. The present volume, dealing with the genus *Halysites*, may be regarded as the first portion of this important work which has been undertaken by Mr. Etheridge.

I have the honour to be,
Sir,
Your obedient servant,
EDWARD F. PITTMAN,
Government Geologist.

The Honourable the Minister
for Mines and Agriculture.

Author's Preface.

With the approval of the Under Secretary for Mines and Agriculture, and the concurrence of the Trustees of the Australian Museum, the Author has undertaken the preparation of a "Monograph of the Silurian and Devonian Corals of New South Wales," chiefly based on specimens contained in the Mining and Geological and Australian Museums in Sydney. To render the work more complete descriptions and illustrations of similar Corals from other parts of Australia will be introduced when practicable.

In consequence of the pressure of other official duties it was found impossible to prepare a Memoir of this description *in extenso*, as a complete work. After deliberation it was determined to publish it in parts, each part to contain the species of one genus at a time, but the genera not necessarily following one another in systematic order. The sequence of the latter will be principally determined by the completeness of the material to hand.

The first, and present part, will contain the species of the Genus *Halysites*. In connection therewith, the Author desires to place on record his indebtedness to the Rev. J. M. Curran, late of the Technical College, and Mr. C. A. Süssmilch, of the same Institution, for the loan of material; to Mr. W. S. Dun, Palæontologist to the Geological Survey of New South Wales, for cordial assistance; to Mr. E. F. Pittman, for the official publication of the work; and to the Trustees of the Australian Museum for permission to use the collection in their charge.

I.—INTRODUCTION.

Two species of *Halysites* are at present known from Australasian Silurian rocks and none from the Devonian. *Halysites australis* is met with at Molong, N. S. Wales, and the other described, although at present unnamed species, comes from the Gordon River Limestone in Tasmania. Through the efforts of the Rev. J. M. Curran and Mr. C. A. Süssmilch on the one part, and Mr. C. Cullen, Collector to the Geological Survey of N. S. Wales, on the other part, a very fine series of specimens has been brought together from the Molong and Canobolas Districts.

Many of these are of large size and very beautifully preserved, being weathered quite clear of matrix. They exhibit the essential anatomical characters quite as well in this condition as in sections prepared for the microscope; upwards of one hundred specimens have in all been examined.

The specific determination of these corals has been rendered most perplexing and difficult in consequence of the widely divergent views held by authors on the relative value of specific characters in *Halysites*, and, in consequence, the chaotic state of the names applied to the various forms. Reference to old-world species is rendered still more difficult by the absence from descriptions, except on the part of a few writers, such as Fischer-Benzon, Nicholson, Lambe, &c., of all allusion to microscopic characters, other than in the most general terms.

After working at the subject for some weeks, I felt that any hard-and-fast references to European or American species, in our present knowledge of these, would be so hopeless, that it became necessary to adopt some other method for the elucidation of the Australian corals. I accordingly endeavoured to arrange the latter, in the first instance in lots, simply on their macroscopic features, and, notwithstanding the contrary opinion held in other parts of the world of the difficulty in so separating species of *Halysites*, I succeeded in grouping the specimens beyond my anticipations. That is to say, the external characters of our corals are sufficiently well marked to render possible the separation of a large parcel into groups of specimens possessing certain features in common that were afterwards found to exhibit similar microscopic details, which appeared to me to be of specific value.

II.—HISTORY OF THE DISCOVERY OF HALYSITES IN AUSTRALASIA.

I HAVE already stated[1] that the late Prof. L. G. de Koninck was the first to record[2] the occurrence of this genus in N. S. Wales. This statement is accurate only in so far as description is concerned, for the late Prof. A. M. Thomson, who, in 1869, accompanied the late Mr. Gerard Krefft to the Wellington Caves, and geologically examined that district, was the first to identify *Halysites* as a N. S. Wales fossil.[3] Subsequent to De Koninck's description, the late Mr. C. S. Wilkinson reported the presence of *Halysites* in beds of marble limestone, ten miles west of Forbes. He remarked,[4] "The presence of this latter genus proves the Upper Silurian age of these beds." The next in order of discovery was apparently the Rev. J. M. Curran, who collected many specimens near Molong, as already recorded by me; Wilkinson placed the Molong Limestones as the "uppermost or 'passage beds'" of the Upper Silurian.[5] In 1898, Mr. Curran's Molong coral was described by me as *Halysites australis;*[6] and in 1900, a note on the Tasmanian form was published.[7] A still more interesting discovery of this coral was made in 1901, at Chillagoe, Queensland, by Mr. B. Dunstan,[8] which opens up a highly important geological question in that State.

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[1] Etheridge, Austr. Mus. Rec., III, Pt. 4, 1898, p. 78.

[2] De Koninck, Foss. Pal. Nouv. Galles du Sud, Pt. 1, 1876, p. 16; or, perhaps more correctly, Mém. Soc. R. Liége, II (2), 1876.

[3] Thomson, N. S. Wales Votes and Proc., IV, 1870–71, p. 1183; Explor. Caves and Rivers N. S. Wales, 1882, pp. 4 and 12. It is possible that a discovery by the late Rev. W. B. Clarke was anterior to this. He said, "Since 1858 . . . I have detected Halysites." (Remarks Sed. Formations N. S. Wales, 4th edit., 1878, pp. 13 and 129.)

[4] Wilkinson, Ann. Rept. Dept. Mines N. S. Wales for 1878 (1879), p. 151.

[5] Wilkinson, Ann. Rept. Dept. Mines N. S. Wales for 1885 (1886), p. 127; *Ibid.* for 1886 (1887), p 133.

[6] Etheridge, Austr. Mus. Rec., III, Pt. 4, 1898, p. 78, pl. xvii.

[7] Etheridge, Proc. R. Soc. Tas. for 1898–99 (1900), pp. xxviii and 81.

[8] Dunstan, Ann. Rept. Dept. Mines Q'land (Q'land Parl. Papers, C. A. 18, 1901), 1901, p. 197; Report Geol. Survey Q'land, No. 159, 1901, p. 21.

III.—DIFFICULTIES MET WITH IN AN ATTEMPT TO IDENTIFY EUROPEAN AND AMERICAN SPECIES OF HALYSITES.

MANY species have been described from time to time, but from the variability that appears to exist in the macroscopic characters—such as size of the corallites and fenestrules,[1] length of the corallite chains,[2] and supposed presence or absence of spiniform septa, &c., and possibly from the absence of microscopic details—the species, both European and American, were reduced by Messrs. H. Milne-Edwards and Jules Haime to two, viz., *Halysites catenularius*, Linn., and *H. escharoides*, Lamk. The two corals in question were separated by these authors, chiefly on the grounds that the corallites differed in size, but both were said to possess twelve spiniform septa in a cycle.

An effort to establish the identity of our Australasian *Halysites* has caused me to peruse a good deal of the literature relating to the genus, and I have been forced to the conclusion that an entire revision of the described species is necessary. This is, of course, out of the question on my part; but I have selected some of the more important writers, both old and recent, whose remarks are referred to with the view of testing the validity of Edwards and Haime's subdivision and synonomy. I have further endeavoured to reduce my notes to tabular form, restricting the characters to those only possessing the highest morphological value. I cannot help coming to the conclusion that a great deal of confusion has arisen through mis-identification —the *H. catenularius* of one author being the *H. escharoides* of another, and so on.

1826.—Goldfuss (A.).[3]—Described and figured two species, *Catenipora escharoides*, Lamk.[4] (with which he united *C. catenulata*,[5] Linn.), and *C. labyrinthica*, Goldf.[6] The only anatomical detail to be made out is the presence of autopores.[7]

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[1] The vacuities or interspaces formed by the union of the lines of corallites; the lacunæ or "irregular reticulations" of Edwards and Haime.

[2] The lines of corallites forming the boundaries of a fenestrule.

[3] Goldfuss, Petrefacta Germaniæ, 1826, pl. xxv, f. 4–5b.

[4] *Halysites escharoides*, Edw. and Haime, 1852 and 1854.

[5] This name will be invariably spelt as by the author quoted.

[6] *Halysites catenularia*, Edw. and Haime, 1852 and 1854.

[7] The largest corallites in a chain.

1830-37.—Fischer de Waldheim (G.).[1]—Described and figured *Halysites escharoides*, Lamk. (with which he also united *H. catenulata*, Linn.), and *H. labyrinthica*, Goldf.[2] Autopores only are again shown.

1834.—Blainville (H. M. de).[3]—In *Catenipora escharoides*, Lamk. described the presence of septa ("lames rayonnantes"), and again united with it *H. catenulata*, Linn.

1839.—Lonsdale (W.).[4]—United *Catenipora escharoides*, Lamk., *C. catenulata*, Linn., and *C. labyrinthica*, Goldf., in one species,[5] using the first of the three names.

1845.—Lonsdale (W.).[6]—Described only *H. labyrinthica*, and said "incipient lamellæ being clearly 12."

1851.—McCoy (F.).[7]—Described *H. catenulatus*, Linn., and united with it *H. escharoides*, Lamk., and *H. labyrinthica*, Goldf. The expression "the small openings of the young tubes [mesopores] most frequently seen at the points of anastomosing" [gonopores], would seem to indicate that McCoy considered specimens representing the foregoing combination of names, expressed under that of the one species,[8] to possess both mesopores[9] and gonopores,[10] without grasping their true meaning. Prof. McCoy further stated that *Halysites* possessed from fourteen to sixteen septa, "internal vertical sulci (rudimentary lamellæ)," and "funnel-shaped diaphragms" [tabulæ].

1852.—Hall (J.).[11]—Described an American form as *Catenipora escharoides*, Lamk.,[12] and a new species *C. agglomerata*. Under the first he referred to the corallites being "in a single series, or separated by a cellular interspace," and again, "septate transversely and striated longitudinally," *i.e.*, possessing both tabulæ and septa. In *C. agglomerata*[13] he noticed the

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[1] Fischer de Waldheim, Oryct. Gouv. Moscou, Pt. 3, 1830-37, p. 163.
[2] *Halysites catenularia*, Edw. and Haime 1852 and 1854.
[3] Blainville, Man. d'Actinologie, 1834, p. 353
[4] Lonsdale, Murchison's Sil. Syst., 1839, p. 685.
[5] *Halysites catenularia*, Edw. and Haime, 1852 and 1854.
[6] Lonsdale, Murchison's Geol. Russia in Europe, 1845, p. 593.
[7] McCoy, Brit. Pal. Foss., Fas. 1, 1851, p. 26.
[8] *Halysites catenularia* (pars), Edw. and H., 1854.
[9] The smallest corallites in a chain.
[10] The corallites of intermediate size at the fenestrule angles.
[11] Hall, Pal. N. York, II, 1852, p. 127.
[12] *Halysites catenularia*, Edw. and H., 1854.
[13] *Halysites catenularia?* Edw. and H., 1854.

mesopores as "spaces between the tubes [autopores] cellular," and the septa numerous, together with tabulæ.[1] Hall appears, therefore, to have been the first, as Nicholson remarked,[2] to *figure* more than one set of corallites in *Halysites*.

1852.—Milne-Edwards (H.) and Haime (J.).[3]—These authors restricted all the then known forms of the genus to two species as already explained. *H. catenularia*, Edw. and H., comprised those corals with large fenestrules, and from three to eight corallites in a chain, and *H. escharoides*, Edw. and H., those with small fenestrules, and two to three tubes in a chain; twelve spiniform septa in both species.

1854.—Milne-Edwards (H.) and Haime (J.).[4]—The same restriction was maintained in the second work by these authors.

1852–54.—Roemer (F.).[5]—As *Halysites catenularia* this author figured a largely fenestrate coral after the type of *H. labyrinthica*, Goldf., with all three forms of corallites, and twelve septal spines.

1860.—Eichwald (E. d').[6]—Described both *H. catenularia*, Linn., uniting with it *H. labyrinthica*, Goldf., and *H. escharoides*, Lamk. In the former there are from three to eight corallites in a chain, with twelve septa, and in the latter eight to ten in a chain, thus increasing the number of serial corallites mentioned by Edwards and Haime. No special reference to the existence of septa is made under *H. escharoides*, but from the fact that the number twelve is mentioned in the generic description, it must be assumed that Eichwald intended this number to apply to Lamarck's species also. He further describes five other species of his own, which Milne-Edwards and Haime distributed between the two type species as synonyms. No reference is made to more than one form of corallite.

1865–66.—Ludwig (R.).[7]—Under the unfortunate generic name of *Ptychophloeolopas!* described and figured *H. catenularia*, Edw. and H. Two

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[1] Hall, Pal. N. York, II, 1852, p. 129, pl. xxxv *bis*.
[2] Nicholson, Tab. Corals Pal. Period, 1879, p. 228, foot-note.
[3] Milne-Edwards and Haime, Polyp. Foss. Terr. Pal., 1852, pp. 283 and 285.
[4] Milne-Edwards and Haime, Mon. Brit. Foss. Corals, Pt. 5, 1854, pp. 271 and 273.
[5] Roemer, Bronn's Lethæa Geog., 3rd Aufl., I., 2 Th., 1852–54, p. 182, pl. v. 8
[6] Eichwald, Lethæa Rossica, I, Pt. 2, 1860, pp. 505–508.
[7] Ludwig, Palaeontographica, xiv, 1865–66, p. 236, pl. lxx, f. 3*a–c*.

calices are very distinctly represented side by side in the same chain, and following one of them a mesopore, also a corallite with rolling tabulæ, or as Ludwig described them "bow-shaped." Twelve septa are represented.

1871.—Fischer-Benzon (R.).[1]—This author's paper was the first real attempt to portray the more minute and detailed structure of *Halysites*. After a long study of a very carefully prepared translation, I have come to the conclusion that from a systematic point of view too much importance cannot be attached to it, and as an exposition of the microscopic structure it stands before any other writing I have access to. Dr. Fischer-Benzon's material appears to have been derived chiefly from diluvial boulders exhibiting little, if any, of the more important external features of the corallums, and from this cause it is, and will remain difficult, to assign his species to already known forms, even if it be found necessary to do so.

In his generic description the author referred to—(1) the free chains;[2] (2) the wrinkled epitheca; (3) twelve or more delicate spiniform septa; (4) the distal ends of the latter sometimes blended into a spurious columella: (5) complete and incomplete tabulæ of the autopores; (6) tabulate nature of the mesopores (thus supporting Hall's description of his *Catenipora agglomerata*) possessing a dual structure—(*a*) saddle-shaped and lenticular vesicles, or (*b*) horizontal tabulæ, enclosing small regular visceral chambers; (7) complicated structure of the intermediate or mesoporal walls; and (8) lateral gemmation.

Fischer-Benzon adopted a classification of his species based on the structure of the mesopores and their walls; and remarked, "as nearly all the earlier figures of *Halysites* are without accurate delineations of the dividing walls [of the corallites], and the peculiar calices are not enlarged, it is difficult to distinguish them from one another, specially so if one has no opportunity of investigating the original specimens." This is perfectly true; but the structural details employed by Fischer-Benzon appear to depend so much on the degrees of development and secondary alteration, that I am afraid his method of classification will not stand the test of future research.

Fischer-Benzon regards the structure of the mesoporal walls, or those separating the mesopores from the autopores, as of great importance. He says, "The nature of these dividing walls seems to me the most certain means

[1] Fischer-Benzon, Abhandl. Gebiete Naturwis. Verein Hamburg, V, 2 Abth., 1871, p. 31 (separate copy), pls. iii.

[2] New chains with a free end projecting into a fenestrule.

of distinguishing individual species from one another, or at least of dividing them into definite groups. The size or even the shape of the individual calices is much less important." And again, "The nature and construction of the dividing walls can supply a means of separating the species of *Halysites* into several groups." According either to his descriptions or figures, the corallites (autopores) are separated (*a*) by two pairs of vertical bars, or "rods," arising from the main chain walls and meeting in the centre, each pair, with the assistance of the latter, thus enclose between them one of Nicholson's "interstitial tubuli," or, as I here term them, mesopores;[1] (*b*) at times these "rods" blend into a single partition at each end of an autopore;[2] (*c*) the longest diameter of these rods may be either parallel to or at right angles to the direction of a chain of corallites;[3] (*d*) after blending, the walls may be so thickened as to all but obliterate the visceral chambers of the mesopores;[4] (*e*) the blending may proceed to such an extent as to ultimately obliterate the intermediate chamber, or mesopore.[5]

The principal points brought out in the specific descriptions are the following:—*Halysites cavernosa*, F.-B., possesses both complete and incomplete tabulæ in the autopores, and there are no spiniform septa; the mesopores are highly vesicular. In *H. regularis*, F.-B., the tabulæ of the autopores and mesopores are practically complete and normal; but the structure of the "rod" walls of the latter is peculiar, and if constant, characteristic of the species. In his conception of *H. labyrinthica*, Goldf., the tabulæ of the autopores are at times very incomplete and highly vesicular, the vesicles large, but those of the mesopores are normal. *H. obliqua* is a septate form, with the peculiarity that certain of the septa proceed from the transverse dividing walls between the autopores; there is no clear evidence of the presence of mesopores. *H. approximata*, Eichw., is said to possess numerous complete ("single") tabulæ. In *H. parallela*, F. Schmidt, the tabulæ are concave ("bent down"). Fischer-Benzon's conception of *H. escharoides*, Lamk., presents several points of very great interest. In the first place, the septa are said to blend at their inner or distal ends into a false columella, often so strongly developed as to become exsert; there are five cycles in a visceral chamber. The mesopores are either

[1] Fischer-Benzon, *Op. cit.*, pl. i, f. 2 and 9.
[2] *Ibid.*, *op. cit.*, pl. ii, f. 5; pl. iii, f. 2.
[3] *Ibid.*, *op. cit.*, pl. i, f. 9; pl. ii, f. 2 and
[4] *Ibid.*, *op. cit.*, pl. iii, f. 3.
[5] *Ibid.*, *op. cit.*, pl. iii, f. 2.

very small or entirely obliterated; and in the former case, the "rods" forming their walls are two at each end, meeting and coalescing in the middle; in the latter case, the walls have a solid and homogeneous appearance; the tabulæ are complete. *H. elegans*, F.-B., also possesses a false columella, and the edges of the autopores are strongly festooned by the septa, of which there are two cycles only to each visceral chamber. *H. quadrata*, F.-B., again has a strongly developed false columella, and both mesopores and gonopores are shown in the figure. In the last species described, *H. jacovickii*, F. de Waldheim, the corallum is built with remarkable regularity, and more or less resembles a *Favosites;* mesopores and gonopores are both present, but the spiniform septa do not coalesce at the calicinal centres.

1873.—Lindström (G).[1]—This author, in describing Swedish Lower Silurian corals, mentions an example of *H. escharoides*, Lamk., from Dalarne, in which the spiniform septa unite at the calicinal centres to form irregular spongy masses, thus confirming Fischer-Benzon's description of his false columella.

1873.—Lindström (G.).[2]—The same writer, in an article on the "Anthozoa Tabulata," described two forms of zooids in *Halysites* as in *Heliolites*. He remarked that between the larger zooids (autopores), with their widely-spaced tabulæ, occurred smaller vesicular tabulate tubes ("cœnenchyma," or our mesopores).

1876.—Rominger (C.).[3]—Dr. Rominger united *H. catenularia*, Linn., *H. escharoides*, Lamk., and *H. labyrinthica*, Goldf. He recognised in a generic sense twelve septa ("longitudinal crests") and "flat diaphragms" (tabulæ), but did not make any reference to corallites of more than one order, although in one figure[4] at least mesopores are shown.

1879.—Nicholson (H. A.).[5]—At the time my deceased friend wrote his masterly work on the "Palæozoic Tabulate Corals," he had not seen Dr. Fischer-Benzon's paper, and he restricted his observations to the two typical Edwardsian species. He distinguished *H. catenularia* by the presence of zooids of two orders and no septal spines, and *H. escharoides* by the possession of corallites of one order only, and these with twelve septal spines

[1] Lindström, Öfvers. K. Vet.-Akad. Forhandl. Stockholm, 1873, No. 4, p. 25.
[2] Lindström, *Loc. cit.*, p. 16.
[3] Rominger, Report Geol. Survey Michigan—Lower Peninsula, 1873-76, III, Pt. 2, 1876, p. 78.
[4] Rominger, *Loc. cit.*, pl. xxix, f. 2.
[5] Nicholson, Tab. Corals Pa Period, 1879, pp. 226-231.

to a cycle. The great value of Nicholson's observations lay in his confirmation of Lindström's previously expressed opinion, that "each colony of the typical *H. catenularia*, Linn., consisted of two structurally and functionally distinct sets of zooids," and in a general way of Fischer-Benzon's researches also. The morphological structure of *Halysites* is fully entered into by Nicholson in his usually clear and lucid style, and his conclusions were briefly as follows:—(*a*) The epitheca and corallite walls are continuous, and the former does not take any part in the formation of the transverse walls; (*b*) the partitions between corallites are formed by their coalesced walls solely; (*c*) corallites are of one or two orders, as the case may be, normal corallites and interstitial tubes; (*d*) when both are present, the tabulæ of the former are complete, and those of the latter sometimes vesicular; (*e*) the normal corallites may or may not be septate; (*f*) the interstitial tubes sometimes appear to possess modified septa; (*g*) the septa are spiniform, arranged in vertical rows, and twelve in a cycle.

1883.—Lindström (G.).[1]—In a Chinese coral referred to *H. catenularius*, Linn., Lindström described twelve short thick septa in the autopores, simple tabulæ, and solid inter-autoporal walls.

1883.—Roemer (F.).[2]—This eminent Palæontologist accepted Fischer-Benzon's views as to the existence of a false columella in some species. He described *H. catenularia*, Linn., with twelve septa extending to near the centre of the corallites, and close and horizontal tabulæ; intermediate tubes (mesopores) sometimes present with similar tabulæ. *H. escharoides*, Lamk., is distinguished only by the less size of its corallites, and a smaller number in a chain.

1890.—Steinmann (G.).[3]—Gives figures and a brief description of *H. catenularia*, Linn. His illustration of the transverse section is copied from Fischer-Benzon's figure of *H. cavernosa*, F.-B., with all its peculiarities. In the longitudinal section complete and incomplete tabulæ are seen in the autopores, and complete in the mesopores.

1894.—Weissermel (W.).[4]—Refers to *H. catenularia*, Linn., as "this easily distinguishable form"! Between every pair of large corallites (autopores) occur one or two small tubes (mesopores), but septa are absent in the

[1] Lindström, Beiträge Pal. China (Richthofen's China, IV), 1883, p. 60.
[2] Roemer, Lethæa Pal., 2 Lief., 1883, p. 486.
[3] Steinmann, Elemente Pal., 1890, p. 109, f. 111.
[4] Weissermel, Zeit. Deutschen Geol. Gesellsch., XLVI, 3 Heft, 1894, p. 661.

former, tabulæ complete, horizontal or curved, but closer in the mesopores than in the autopores. Refers to the presence of septa and absence of mesopores in *H. escharoides*. Subscribes to the dimorphic theory of Nicholson,[1] and supports it by figuring a *H. catenularia*, with mesopores, and with spiniform septa in one of the autopores.

1896.—Sardesson (F. W.).[2]—This author uses the term autopore for the largest corallites in a chain, as here adopted, but Nicholson's interstitial tubuli are termed siphonopores, one between each pair of the former, in *H. catenularia*, Linn. He describes pseudo-septa and close, horizontal, or oblique tabulæ in the autopores, and states that budding takes place chiefly from the chain junctions (gonopores, *mihi*). In *H. escharoides* there are twelve pseudo-septa, meeting at their distal ends, but mesopores are "seldom" developed.

1899.—Lambe (L. M.).[3]—No writer has more forcibly recognised the great difficulties attending the discrimination of species in this genus than Mr. Lambe. He states that the structure of Canadian specimens does not bear out Nicholson's method of distinguishing the species by their internal structure—the presence or absence of both spiniform septa and secondary corallites (mesopores).[4] It must not be forgotten, however, that Nicholson confined his remarks to the two Edwardsian type species.

As *H. catenularius* proper, Mr. Lambe figures a coral with autoporal spiniform septa and mesopores; the tabulæ of the autopores are horizontal or slightly concave, and those of the mesopores close-set, strongly arched, and almost at times vesicular. The last condition shows a remarkably close affinity to Fischer-Benzon's longitudinal section of *H. cavernosa*, F.-B. Var. *quebecensis*, Lambe, differs by possessing narrow mesopores with distant horizontal tabulæ, and in the absence of the spiniform septa of the species in chief. Var. *gracilis*, Hall, is without mesopores, but autoporal septa are present, and the tabulæ are distant, horizontal, concave, or rolling. Var. *simplex*, Lambe, possesses very large autopores, questionable spiniform septa, and no mesopores, the tabulæ are wide apart, horizontal, concave, rolling, or sub-vesicular here and there. Var. *amplitabulata*, Lambe, is a very interesting form in which the mesopores are "as large as and even larger than" the

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[1] Nicholson, Tab. Corals Pal. Period, 1879, p. 230.

[2] Sardesson, Neues Jahrb. Min., Beil. Bd. X, 2 Heft, 1896, p. 272.

[3] Lambe, Contrib. Canadian Pal., IV, Pt. 1, 1899, pp. 64–78.

[4] Lambe, *Loc. cit.*, pp. 66 and 67.

autopores, with very close-set "coalescent" or vesicular tabulæ, those of the autopores being "comparatively regular and distant"; this vesicular structure again indicates a departure towards *H. cavernosa*, F.-B.; there are no spiniform septa. Var. *nitida*, Lambe, possesses septa in the autopores and mesopores, with very compact, regular, and horizontal or slightly concave tabulæ in both.

If Mr. Lambe is correct in referring these diverse forms of structure to the typical *H. catenularius*, Linn., as varieties, and I say "if" without the slightest wish to impugn the accuracy of his determinations, then it certainly seals the fate of Nicholson's suggested method of distinguishing between the two supposed type species. For my own part I much prefer to regard Lambe's varieties as separate species.

1902.—Počta (P.).[1]—The observations of this author, one of the most recent writers on *Halysites*, are of importance. His study of the Bohemian corals leads him to conclude that only two species are well-defined—the two typical forms of Milne-Edwards and Haime. He unhesitatingly accepts Nicholson's method of separating them, and states that the spiniform septa vary from twelve to fifteen, but the coral with zooids of two orders (*H. catenularius*, Linn.), rarely possesses them. Mr. Počta is unable to confirm Fischer-Benzon's description of vesicular tabulæ in *Halysites* from personal observation, but he records a new and very important feature in *H. escharoides*, the closing of the autopores by oval, concentrically-striated opercula, probably the uppermost tabulæ, as in some *Favosites*.

[1] Počta, Barrande's Syst. Sil. Bohême, VIII (ii), 1902, pp. 272–275.

Author.	Halysites catenularius, *Linn.*							Halysites escharoides, *Lamk.*						
	Autopores.	Autoporal septal spines.	Autoporal tabulæ.	Mesopores.	Mesoporal septal spines.	Mesoporal tabulæ.	Gonopores.	Autopores.	Autoporal septal spines.	Autoporal tabulæ.	Mesopores.	Mesoporal septal spines.	Mesoporal tabulæ.	Gonopores.
1826—Goldfuss	Figd. ..	.....	.....	.....	....	.....	....	Figd. ..	.....	....	....	....	....	....
1830-37—Fisher de Waldheim.	,, ..	.....	.....	.....	....	.....	....	....	.....	....	....	....	....	....
1834—Blainville	.....	.....	.....	.....	....	.....	....	....	Described..	....	....	....	....	....
1839—Lonsdale	Figd. ..	.....	.....	.....	....	.....	....	. ..	.....	....	....	....	....	....
1851—McCoy[1]	Described	14-16	Funnel-shaped	Inferred ..	....	.....	Inferred..	....	.....	....	....	....	....	....
1852—Hall.....	Desc. and figd.	Described..	Described.....	Described..	....	.....	....	Desc. and figd.[6]	Described..	Hor. or oblique.	Present or absent.	....	....	....
1852—Milne-Edwards and Haime.[2]	Described	12, to centre	Hor. and close	.....	....	.....	....	Described.[7]	12	Close	....	....	....	....
1854—Milne-Edwards and Haime.	,,	,,	,, ...	.....	....	.....	....	,,	12	,,	....	....	....	....
1852-54—F. Roemer ..	Figd. ..	12	.....	Figd.....	....	.....	Figd.....	....	.....	....	....	....	....	....
1860—Eichwald[3]	Described	12, to centre	.....	.....	....	.....	....	....	.....	....	....	....	....	.. .
1865-66—Ludwig	Figd. ..	12	Rolling.....	Figd.....	....	.....	....	....	.....	....	....	....	....	....
1871—Fischer-Benzon..	.....	.....	.....	.....	....	.....	....	Desc. and figd.	12, blending into a false columella.	Hor. or rolling.	Small or obliterated.	....	Hor. ..	Figd
1873—Lindström	.....	.....	.....	.....	....	.....	....	....	12, blending into a false columella.	....	....	....	....	....
1876—Rominger[4].....	Figd. ..	12	Flat	Figd.....	....	.....	....	....	.....	....	....	....	....	....
1879—Nicholson	Desc. and figd.	.....	Remote, oblique, rolling, or vesicular.	,, ...	Figd.....	Close, hor., or subvesicular.	Figd. ..	Desc. and figd.	12	....	....	....	....	....
1883—Lindström	Described	12	Complete	.....	....	.....	....	....	.....	....	....	....	....	....
1883—F. oemer	,,	12, to centre	Close and hor.	Sometimes present.	....	Close and hor.	....	....	.....	....	....	....	....	....
1890—Steinmann	Figd. ..	.....	Distant, curved, or vesicular.	Double or treble.	....	,,	....	....	.....	....	....	....	....	....
1894—Weissermel.....	,, ...	Occasionally present.	Hor. or curved	Single or double.	....	Close, and hor.	....	Described	12	....	....	....	....	.. .
1896—Sardeson	Described	Described..	Close, hor., or oblique	Small	...	Close	....	,,	12, blending at centre.	....	Seldom present.	....	....	....
1899—Lambe[5]	Desc. and figd.	12, or absent	Close or distant; hor., concave, and rolling or subvesicular.	Present or absent.	....	Close, arched, hor., or vesicular.	....	....	.....	....	....	....	....	....
1902—Počta	Desc. and figd.	Rarely present.	Hor. or concave, opercula.	Figd.....	....	Close, hor., or concave.	Figd. ..	Described	12-15	....	....	....	....	....

[1] McCoy included *H. catenularius*, *H. escharoides*, and *H. labyrinthica*, under the first of these names. [2] Under *H. catenularius*, these authors included *H. labyrinthica*, Goldf., the same of both Fischer de Waldheim and Bronn, and *H. escharoides* of Lonsdale in 1839, and Hall. [3] Includes *H. labyrinthica*, Goldf., with *H. catenularius*, Linn. [4] Included *H. catenularius*, Linn., *H. escharoides*, Lamk., and *H. labyrinthica*, Goldf., in one. [5] Combining the characters of his *H. catenularius* and its varieties. [6] *H. escharoides*, Hall, was referred to *H. catenularius*, Linn., by Milne-Edwards and Haime in 1854. [7] Including *H. escharoides*, Goldf., and *H. jacovicki*, F. de W.

In the foregoing table I have endeavoured to portray, imperfectly I am afraid, the principal characters assigned to the two species by the more important authors. It exemplifies how diffcult it is to say, with our present imperfect knowledge of the two corals, what is *H. catenularius*, Linn., and *H. escharoides*, Lamk., respectively. Upon this point depends, it seems to me, the validity of all other specific names from time to time proposed in *Halysites*. If specific variation is to be accepted as of any value at all, more particularly as applied to stratigraphy, it appears impossible that such apparently different types, as for instance *H. catenularius*, Nicholson, Počta, Lambe, &c., *H. escharoides*, F.-B., *H. elegans*, F.-B., *H. gracilis*, Lambe, the vars. *quebecensis*, Lambe, *nitida*, Lambe, *simplex*, Lambe, *H. cavernosa*, F.-B., and many others, can be one or other of the restricted Edwardsian forms, as the case may be. Rominger remarked[1] on the difficulty of arriving at specific separation through the "great variability of form" existing among his Michigan corals, but at the same time he appears to have been struck with the fact that "various specific forms exist." Prof. Nicholson and the Writer again, in 1880, wrote as follows:[2]—"We hardly think that it is at present possible to define with certainty the different species of the genus *Halysites*. A very vast mass of material will have to be submitted to microscopic examination before it will be possible for the observer to assert positively whether the above-mentioned important structural differences are constant and of specific value, or whether they are merely due to individual variation, or referable to other causes, such as the influence of sex, the temporary condition of the corallum as to the production of ova, or of the actual dimorphism or polymorphism of the species."

No one has more fully recognised the difficulties of specific determination in this genus than Mr. Lambe, who says[3]:—"If an arrangement according to the outside form be attempted, or if the inner structure be relied on only as a basis for classification, it will be found almost impossible to arrive at satisfactory conclusions." This expression of opinion is, however, somewhat discounted by the apparently contradictory statement that "the variations in the general manner of growth of the corallum . . . . and the marked differences to be found in the inside structure appear to be sufficiently constant at different geological horizons to allow of varieties with certain characteristics

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[1] Rominger, Report Geol. Survey Michigan—Lower Peninsula, 1873-76, III, Pt. 2, 1878, p. 78.
[2] Nicholson and Etheridge, Mon. Sil. Foss. Girvan, 1880, Pt. 3, p. 276.
[3] Lambe, Contrib. Canadian Pal., IV, Pt. 1, 1899, p. 65.

being considered distinctive of the horizons in which they are found :"[1] and again :—" It is found, however, that the *Halysites* of different geological horizons have distinctive characteristics which are apparently constant."[2] What is this but specific distinction ?

On this horizon question, a previous writer, Prof. R. P. Whitfield, speaking of the *Halysites* of the Niagara Formation of Wisconsin, remarked :[3]— "It is also noticed that the specimens of the three varieties do not usually occur at the same locality, or if so, that some one of the varieties will greatly predominate, either at the locality or in a certain horizon, while the others are present only in limited numbers."

Either, therefore, Nicholson's views of the di- or polymorphism of the corallum is correct, and equally so Lambe's system of relegating all the Canadian forms but one to the position of varieties of *H. catenularius* is equally correct, the only differentiation being that of geological horizon ; or, on the other hand, there are more than the two principal specific types selected by Milne-Edwards and Haime. From the point of view of practical Palæontology as an aid to stratigraphy, it appears to me the better course to pursue, pending the appearance of a complete Monograph on the whole supposed species constituting the genus, will be to regard all well-marked forms, such as many of Mr. Lambe's are, as distinct species. This is the course I have pursued in regard to our Australian forms, for whatever may be the case with European and American species, I am able to differentiate the first both by external characters on a broad scale, aided by the internal structure.

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[1] Lambe, *Loc. cit.*, p. 65.
[2] Lambe, *Loc. cit.*, p. 67.
[3] Whitfield in Chamberlin, Geol. Wisconsin—Survey, 1873–79, IV, Pt. 3, 1882, p. 271.

IV.—THE GENERAL STRUCTURE OF AUSTRALIAN HALYSITES.

1. *Mode of Preservation.*—All the specimens I have examined are calcareo-siliceous, *i.e.*, traces of the original calcareous tissue are retained in places, but the greater portion of each corallum has either been simply silicified, or has undergone a secondary change, and is converted, more or less, into chalcedony, and Beekite rosettes are often visible on the exterior of the walls. The entombing matrix being in a great measure calcareous, the resulting weathered specimens are, as a rule, in a beautiful state of preservation. Some are far more silicified than others, and in a few exceptional cases secondary silicification is carried sufficiently far to obliterate in a great measure structural details.

2. *Form and Dimensions.*—No absolutely perfect corallum has come under my notice. The growth outline of the *Halysites* found in N. S. Wales appears to be restricted to three types—(*a*) a lax and spreading shrub—like corallum forming masses up to eight inches in height by nine inches in width; (*b*) expanding sub-pyriform colonies, the component corallites radiating, but not curving, from a comparatively narrow base of attachment (*H. lithostrotonoides, H. Süssmilchi*, &c.), forming masses up to seven inches high by six wide on the upper surface; (*c*) thick tabular masses (*H. perestephesicus*, &c.), ranging up to two feet long by ten inches wide, but the total height unknown. I have not seen sufficiently perfect examples of either the Queensland or Tasmanian corals to be able to speak with any certainty as to their forms, nor have I observed any trace of a *Syringopora*-like growth in corals such as referred to by Prof. H. A. Nicholson[1] in connection with *H. catenularius*, var. *Fieldeni*, Eth.[2] In this instance I do not quite understand my late friend's remarks. Although referring to the variety as of peculiar growth, Mr. Etheridge does not in any way allude to the presence of connecting tubes between the corallites, and one can only surmise that a re-examination of the type revealed these to Prof. Nicholson.

3. *Mode of Attachment.*—Dr. Fisher-Benzon says his example of *H. parallela*, F. Schmidt, was attached to a *Cyathophyllum*.[3] Of two specimens in the Geological Survey Collection one has every appearance of being adherent

[1] Nicholson, Man. Palæontology, 3rd Edit., 1889, p. 340.
[2] Etheridge, Quart. Journ. Geol. Soc., 1878, XXXIV, p. 583.
[3] Fisher-Benzon, Abhandl. Gebeite Naturwis. Verein Hamburg, V, 2 Abth., 1871, p. 20.

to a *Favosites*, and the other to a *Heliolites*, but in both cases the area of attachment is restricted by the form of the supporting coral. In other species (*e.g.*, *H. cratus*) there is every appearance of a much expanded base, as if the colonies had adhered to a large object, neither is this surface in one plane, but undulating and uneven. Nicholson says the colony of *Halysites* in the early condition is not unlike that of an *Aulopora*.[1]

4. *Epitheca.*—The epitheca, notwithstanding the change in mineral composition, is usually well displayed on the exterior of the corallites as fine, closely set, fluctuating, or rolling, transverse lines, continuous around all sides of the fenestrules. As Nicholson has observed,[2] it does not take any part in the formation of the transverse walls bounding the larger corallites. From Mr. Etheridge's remarks on his *H. catenularius*, var. *Fieldeni* from the Arctic Region, already referred to, it would appear as if a basal epitheca existed also.

5. *Fenestrules.*—These are the "masse lacuneuse" and "irregular reticulations" of Milne-Edwards and Haime, and the "interspaces" of Lambe. The fenestrules are enclosed by the union of the corallite chains, and vary considerably in size within certain limits; from two millimetres in both diameters up to fourteen millimetres by twelve, twenty-three by one, and twenty-five by three. The outline is subject to much variation, they may be round, oval, polygonal, labyrinthine, convoluted, irregularly oblong, or almost square, even S— and dumb-bell shaped; the polygons, usually longer in one diameter than the other, may be pentagonal, hexagonal, or heptagonal. The walls, which are equally the coalesced corallite walls, are always strong, and either flat and barely ribbed longitudinally, or transversely undulate in varying degrees, owing to the more or less farcimentiferous outline of the corallite chains. On the whole, the largest fenestrules appear to be in *H. australis*. There is not any particular arrangement of these interspaces except in one species (*H. peristephesicus*), where there appears to be an effort to cluster or revolve round certain centres.

6. *Corallite Chains.*—I employ the term corallite chain to distinguish the zooidal apertures arranged in linear sequence along each angle of a fenestrule, and by ultimate intersection enclosing the latter. They are to some extent the "grandes lames flabelliformes" of Milne-Edwards and Haime, and the "lamina" of Nicholson and Lambe. The outline of a chain depends

[1] Nicholson, Man. Palæontology, 3rd Edit., 1889, p. 339.
[2] Nicholson, Tab. Corals Pal. Period, 1879, p. 227.

on the form of the corallites composing it, both autopores and mesopores, and appears to be one of the best of the minor macroscopic characters for specific distinction. The length of each chain depends naturally on the number of corallites composing it, and its outline on the degree of farcimenticity of the line of corallite openings. This sausage-string-like outline is least marked in *H. lithostrotonoides* and *H. australis*, and very strongly so in *H. pycnoblastoides*, *H. peristephiscus*, and *H. cratus*. The more geometric the outline of a fenestrule the shorter will be the chains bounding it, as in *H. lithostrotonoides*. As a general rule, the chains surrounding a fenestrule all originate from gonopores at the angles of the latter, but in some species, the chains not only do this, but also unite with one another in the centre of their straight courses, or in the case of a form possessing very labyrinthine fenestrules from the rolling side of the latter.

7. *Imperfect Chains.*—It occasionally happens that a chain of corallites is incomplete, projecting into an already completed fenestrule, without attachment at its distal or outer end. This will be more fully treated of under ***Reproduction.***

8. ***Form and Structure of Corallites.***—The corallites are cylindroidal, quadrangular, or polygonal, according to their position in a chain. As a rule, the cylindroidal are the largest tubes, and are termed autopores; the polygonal are the medium in size, and the quadrangular the smallest, called by me the gonopores and mesopores respectively. It is customary to describe the corallum as consisting of corallites of two orders only—the "normal corallites" of Nicholson, or "autopores" of Sardesson,[1] and the "interstitial tubes" of Nicholson, or "tubules" of Lambe. I use the term autopore as Sardesson did, to imply the large cylindroidal corallites; and I borrow the term mesopore for the smaller tubes in a chain, interpolated between the larger, first indicated by McCoy and Hall, and subsequently by Lindström. I am further of opinion that a third set of corallites exists, which I term gonopores. In general terms, it may be stated that all the corallites are long and tubular, and all the enclosing walls are imperforate.

(*a*) *Autopores.*—In the Australian species these are always the largest in the colony, and are invariably cylindroidal, placed end to end, when not separated by a mesopore in the chain line, or by a gonopore at the fenestrule angles. The autopores vary in outline to some extent—they may be oval,

[1] Sardesson, Neues Jahr. Min., Beil.-Bd. V, Heft 2, p. 272.

long-oval, round-oval, almost completely circular, or nearly quadrangular. The autopores are always tabulate; and when septal spines are present, they occur in these tubes.

(*b*) *Mesopores.*—These tubes vary very much in form and size. In the Chillagoe and Tasmanian corals, possibly identical, mesopores seem to be absent; but as the specimens I have seen are not in too good a state of preservation, I do not lay great stress on this point. In *H. orthopteroides* the mesopores are reduced to mere slits; in *H. australis*, *H. cratus*, *H. lithostrotonoides*, and *H. pycnoblastoides*, the outline varies from quadrangular to oblong (parallelogrammatic). In *H. peristephesicus*, these tubes are oblong only, and in *H. Süssmilchi* triangular, quadrangular, or oblong. In the last species, and in *H. gamboolicus*, they are sometimes double. The outlines of any of the mesopores are sometimes modified, so far as the angles are concerned, by subsequent thickening, or secondary siliceous alteration. The presence of more than one mesopore between two autopores is interesting, because it tends to bear out statements to this effect made by other authors. Fischer-Benzon figured[1] double and even treble mesopores in his *H. cavernosa*, and Steinmann copied[2] his figure, referring it to *H. catenularius*, Linn. Weissermel also described[3] the presence of more than one mesopore between two autopores in the same species; and he also figured[4] two between the autopores in a specimen referred to *H. approximata*, Eichw. At the same time, the more complex mesoporal structures figured by Fischer-Benzon have not come under my notice. The mesopores are invariably the smallest zooids in the corallum, and there is not the least approach to the remarkable equality in diameter between them and the autopores figured by Lambe in his *H. catenularius*, var. *amplitabulata*.[5]

(*c*) *Gonopores.*—I employ this term to distinguish the corallites, more often than not, occupying the angles of the fenestrules, and from which in nearly every case new chains arise; they always lie between two autopores. I find that, within certain limits, they are of a different shape to either the autopores or mesopores of a given species, and are always either intermediate in size, or nearly equal to that of the autopores. Furthermore, in some cases, although not in all, the tabulæ are differently spaced to those of the other

[1] Fischer-Benzon, Abhandl. Gebeite Naturwis. Verein Hamburg, V, 2 Abth., 1871, t. 1, f. 2.
[2] Steinmann, Elemente Pal., 1890, p. 109, f. 3 A.
[3] Weissermel, Zeit. Deutschen Geol. Gesellsch., XLVII, 3 Heft, 1894, p. 661.
[4] Weissermel, *Ibid.*, p. 662, f. 4.
[5] Lambe, Contrib. Canadian Pal., IV, Pt. 1, 1899, pl. iv, f. 4*a*.

tubes. If, therefore, a distinction is to be made between the "normal" corallites and the "interstitial tubes," or "tubules," I fail to see why a third group of zooids should not be recognised, provided such zooids can be shown to possess distinctive features of their own. They are always larger than the mesopores, and usually less than the autopores, are always non-septate, and present in all the Australian species; but in three of the latter, these gonopores are not invariably present at every fenestrule angle. They may be recognised by their outline, triangular or quadrangular, irrespective of position; but the commoner outline is polygonal, the hexagonal predominating. Instances of more than one gonopore at a fenestrule angle have been observed, double as in the case of some mesopores, and even triple are occasionally seen, and here and there the geometric outline is departed from, the latter becoming irregular, such as longitudinally elongated, or bent in their course. Like the mesopores, the gonopores are liable to be filled up by stereoplasmic matter, and then become more or less obliterated. It may be taken for granted that the shorter the corallite chains the more numerous the gonopores. A good illustration of the hexagonal form will be found in that of *H. labyrinthica*, by Fischer-Benzon[1]; and Počta figures[2] a gonopore in *H. catenularius*, showing loss of outline from the deposition of secondary matter. The gonopores are intimately associated with the gemmation to be referred to later.

9. *Corallite Walls.*—The walls of all the corallites vary in thickness in ratio to the amount of secondary alteration the tissues have undergone, and their condition can only be accepted in a secondary sense as a feature influencing specific determination. In some instances the transverse or mesoporal walls are traversed by dark lines, apparently representing the primordial walls. When secondary silicification has not been carried to an extreme extent, the walls have a fibrous appearance; but I have not been able to distinguish a similar difference in structure to that described by Sardesson[3] between the fenestrule, or main walls, and the transverse or mesoporal walls. When secondary silicification is carried to its most extreme condition, the walls, particularly the main or fenestrule, are more or less entirely destroyed by conversion into chalcedonic blebs.

10. *Septal Spines.*—These have been detected in five of our forms, and are thorn or spine-like protuberances extending into the visceral chambers for variable distances. The cycles between any two tabulæ vary from two to three, and in only one instance have I been able to satisfactorily count the

[1] Fischer-Benzon, Abhandl. Gebeite Naturwis. Verein Hamburg, V, 2 Abth., 1871, pl. 1, f. 9.
[2] Počta, Barrande's Syst. Sil. Bohême, VIII (ii), 1902, pl. cxvi, f. 5.
[3] Sardesson, Neues Jahrb. Min., Beil.-Bd. X, 2 Heft, 1896, p. 273.

number in a cycle, and am led to believe that it does not exceed twelve. The spines are confined strictly to the outer or autoporal walls, except in a few of the autopores of *H. australis*, where one takes its origin from each of the transverse or mesoporal walls, as shown by Fischer-Benzon in his *H. obliqua*,[1] or by Lambe, both in his figure of *H. catenularius*,[2] and that of the var. *gracilis*, Hall.[3] Similarly, I have not seen septal spines in the mesopores proper, as in Nicholson's figure[4] of those in *H. catenularius*.

11. *False Columella.*—No trace of a false columella has been seen in any of the Australian *Halysites*, although in *H. australis* the septal spines meet at the calicinal centre without coalescing.

12. *Tabulæ.*—Tabulæ are particularly well developed in all three forms of zooids throughout the Australian species. As a rule, they are complete, and there is but little evidence of vesicular structure, as in some exotic forms. For instance, the frequent anastomosis of the autoporal tabulæ figured by Nicholson in *H. catenularius*, Linn., in *H. cavernosa*, by Fischer-Benzon, and more particularly by Steinmann in his conception of the first-named species, has not been observed. Not a single instance of the highly vesicular nature of the mesoporal tabulæ, like that of *H. cavernosa*, F.-B., nor the crowded lenticular vesicles of Lambe's var. *amplitabulata*, nor yet the arched tabulæ of *H. catenularius* proper, of the same author, have been seen. In nearly all our corals, these diaphragms may be said to be distant from one another, and, as a rule, equidistant, but here and there occasional patches of close tabulæ are met with. They may be on the same level in contiguous autopores, or alternate, and mostly horizontal; but oblique, concave, bent, or rolling floors, have been noticed.

The mesoporal tabulæ are horizontal and regular, sometimes on the same level as those of bounding autopores, at other times alternate.

The gonoporal tabulæ are generally similar to those of the mesopores. As regards their distance apart, they are, as a rule, intermediate between those of the other two zooids. Rolling tabulæ were observed in *H. pycnoblastoides*.

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[1] Fischer-Benzon, Abhandl. Gebeite Naturwis. Verein Hamburg, V, 2 Abth., 1871, pl. ii, f. 5.
[2] Lambe, Contrib. Canadian Pal., IV, Pt. 1, 1899, pl. iii, f. 2*a*.
[3] Lambe, *Ibid.*, pl. iii, f. 5*a*.
[4] Nicholson, Tab. Corals Pal. Period, 1879, pl. xi, f. 1.

13. *Gemmation.*—This is an intricate and difficult branch of the subject, for very little appears to be known about the initiatory stages of *Halysites*; and I regret that the Australian species do not assist in a solution of the problem. Lindström, in 1873, seems to have been the first, so far as I can gather, to refer to the early stage of this coral. He compared[1] its commencement to that of *Heliolites*, and said—"From the cœnenchyma [? mesopore] which is formed on one side of the first calyx, a new calyx is produced, and beside this another one, so that one can say that Halysites is a Heliolithid, in which the calices form a line with one another, and not round each other. With full-grown and large Halysites colonies, the budding takes place in the same way, calices grow out of the cœnenchyma as in the Heliolithids."

I cannot find any reference on this important matter by Nicholson in his work, "Tabulate Corals of the Palæozoic Period"; but in the last edition of the "Manual,"[2] he states that increase takes place by "stolonal gemmation." According to the late Prof. F. Roemer,[3] the first condition of growth was unknown at the time he wrote. If I understand his remarks rightly, he believed that cells arose on opposite sides from a mother-cell, further propagation taking place by lateral budding; this is not far removed from the previously expressed view of Lindström.

The observations of Počta are of importance, as he appears to foreshadow a dual form of budding, such as I believe to exist, as well as a modified form of earlier stolonal gemmation. Počta says:[4] "Reproduction is effected by lateral budding. Upon the mother-cell there rises a bud with a circular section; the latter becomes elliptic, when the corallite unites with a neighbouring new cell. . . . . Budding may take place, not only on the narrow margin of the cell, but also on the broad [*i.e.*, lateral] side. Upon the former, the new corallite continues the range [*i.e*, chain of corallites]; on the other hand, upon the latter it forms the commencement of a new ribbon [*i.e.*, chain of corallites], which extends by the further addition of new cells."[5] I take it that his *côté étroit* (which I have translated narrow margin) refers to the mesoporal or cross-wall, transverse to the line of growth; and so his *côté large*, I have rendered lateral margin. This can only refer to the

[1] Lindström, Öfvers. K. Vet.-Akad. Forhandl. Stockholm, 1873, No. 4, p. 16.
[2] Nicholson, Manual Pal.. 3rd edit., 1889, p. 339.
[3] Roemer, Lethæa Pal., 2 Lief., 1883, p. 484.
[4] Počta, Barrande's Syst. Sil. Bohême, VIII (ii), 1902, p. 274.
[5] Počta, Barrande's Syst. Sil. Bohême, VIII (ii), 1902, p. 274.

long or epithecate wall of each corallite, particularly as the zooid so produced forms the commencement of a "nouveau ruban," and invariably marks the point of deflection of one or more chains, to assist in enclosing a fenestrule. That corallites occur at the fenestrule angles, differing in outline from the other two kinds of tubes, seems to be just the point missed by Počta. That these exist needs no further demonstration; that their function when present was to produce new chains of corallites, is equally apparent. It seems to me, therefore, that in *Halysites* there is evidence of (*a*) gemmation from the walls of either autopores or mesopores; and (*b*) budding from a set of specially constituted zooids usually occupying that position in the colony forming the angles of the fenestrules. The existence of incomplete chains protruding into already formed fenestrules, and commencing their course from a gonopore, either at one of the re-entering angles, or an obtuse angle on one of the sides of a fenestrule, bears out my view of the reproductive nature of the gonopores. My contention is also supported by figures of the very young state of forms referred to *H. catenularius*, Linn., and *H. escharoides*, Lamk., by Mr. C. Wiman.[1]

14. *Species.*—I have subdivided the Australian *Halysites* into nine species. As already explained, I find it impossible to refer these to old-world or American forms; but I have endeavoured to indicate, wherever possible, an alliance with the latter. The eight species are—

Halysites lithostrotonoides, sp. nov.
,, *orthopteroides*, ,,
,, *Süssmilchi*, ,,
,, *cratus*, ,,
,, *australis*, Eth., fil.
,, *pycnoblastoides*, sp. nov.
,, *peristephesicus*, ,,
,, *gamboolicus*, ,,
,, *chillagoensis*, ,,

[1] Wiman, Bull. Geol. Inst. Univ. Upsala, V, Pt. 2, No. 10, 1902, pl. vii, f. 1 and 2, 6-8.

V.—DESCRIPTION OF THE SPECIES.

Genus—HALYSITES, *Fischer de Waldheim*, 1813.

(Zoognosia, 3rd. Edit., 1813, p. 287.)

A.—SPINIFORM SEPTA absent.

HALYSITES LITHOSTROTONOIDES,[1] *sp. nov.*

(Plate I, Fig. 1; Pl. IV, Figs. 1 and 2; Pl. IX, Fig. 4.)

Sp. Char.—Corallum consisting of a pyriform bunch of corallites subradiate from a common base, forming colonies at least five inches high and four inches wide. Fenestrules polygonal (pentagonal, hexagonal, and heptagonal), occasionally irregular or labyrinthine, but, on the whole, very regular, compact, and reminding one of a roughly-laid tesselated pavement; sizes 2 x 2 mm., 3 x 2 mm., 4 x 2 mm., 5 x 1 mm., 5 x 2 mm., and so on; margins nearly straight, in one alignment; walls flat, *i.e.*, in one plane, and to all intents and purposes level, barely at all ribbed or corrugate. Corallites, in general, long. Epitheca, transversely striate. Corallite chains farcimentiform only in the very slightest degree, hardly at all undulating the outlines of the fenestrules. Autopores long, parallelogrammatic, and very regular in form, margins straight; from one to four in each corallite chain, five being the greatest number observed, and three the average; from three-quarters to one millimetre in length by one-third millimetre in width; visceral chambers nearly square in longitudinal section; tabulæ complete, horizontal, half millimetre apart. Gonopores larger than the mesopores, polygonal (pentagonal, or hexagonal), and a few quadrangular; walls as thick as those of the mesopores. Mesopores quadrangular to parallelogrammatic, and narrow; longest diameter about one-quarter millimetre, at right angles to the direction of the corallite chains; walls less in width than those of the autopores, and often showing a dark dividing line; tabulæ complete, horizontal, one-quarter millimetre apart; visceral chambers longitudinally parallelogrammatic.

Obs.—This coral, viewed macroscopically, presents a very regular and compact appearance; so much so, that when the corallites are seen, either in weathered condition or in transverse section, the autopores and mesopores have a general resemblance to the septate filamentary thallus of an alga, and the united chains to a roughly-laid tesselated pavement.

The farcimentiferous outline of the corallite chains is all but absent, and, in consequence, the margins of the calices are nearly straight in one continuous alignment, and the faint corrugation of the fenestrule walls, as a

[1] λιθόστρωτον, τό—"a tesselated pavement," and *oides*—"resemblance."

whole, is insufficient to break the regular continuity of the fenestrule margins. So strong a contrast is presented by this character to that prevailing in the other species that examples of *H. lithostrotonoides* can be at once picked out with the aid of the naked eye alone.

The horizontal position of the complete tabulæ is maintained with great regularity, very rarely an oblique or concave partition occurs. Increase by gemmation is frequently well exposed in longitudinal weathered sections, with the resulting incomplete chains of corallites. I figure an excellent instance of the commencement of such a chain from an angle of a fenestrule (Pl. IX, Fig. 4), and the gradual building up of the chain.

In one specimen referred to this species, the gonopores at the fenestrule angles are either single, double, or triple. When more than one is present, the additional corallite or corallites are always much smaller than the principal tube. In longitudinal sections, the gonopores can only be distinguished from the autopores by a difference in the diameter, and a slight difference in the distance apart of the tabulæ, which is intermediate between that of the autoporal and mesoporal tabulæ.

The only condition of variation that takes place, other than above, is in a slight increase or decrease, as the case may be, in the size of the fenestrules, and a corresponding difference in the diameters of the three forms of corallites composing a chain, but the number of the latter in a chain is not increased thereby.

The points I rely on for the specific separation of *H. lithostrotonoides* are (1) the regularity of the marginal outline of the corallite chains, whereby the lateral margins of the autopores and mesopores are brought into one alignment, instead of the mesopores occupying re-entrant angles; (2) the consequent absence of a farcimentiform appearance of the corallites.

In its continuous and barely perceptible farcimentiferous outline of the corallite chains, this species resembles *H. catenularius*, var. *gracilis* (Hall), Lambe,[1] but the other details of structure in the two forms are quite different. The habit of the present coral as regards growth, outline of the fenestrules, and general appearance is that of *H. escharoides*, Lamk., as figured by Goldfuss.[2]

Loc. and Horizon.—Beds *a* and *d*, Spring Creek, Portions 98, 221 and 222, Ph. Barton, Co. Ashburnham (*J. M. Curran* and *C. A. Süssmilch*).

Collections.—Australian Museum and Technical College, Sydney.

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[1] Lambe, Contrib. Canadian Pal., IV, Pt. 1, 1899, pl. iii, f. 5, 5*a*.
[2] Goldfuss, Petrefacta Germaniæ, 1826, pl. xxv, f. 4*a*–*b*.

HALYSITES ORTHOPTEROIDES,[1] *sp. nov.*

(Pl. III, Figs. 1 and 2; Pl. VII, Figs. 4 and 5.)

Sp. Char.—Corallum massive, formed by large colonies, several inches in diameter, of parallel and non-radiate corallites. Fenestrules large, polygonal, labyrinthine, curved, or generally irregular in form, with pronounced angles, or wholly rounded outlines; sizes 6 x 5 mm., 8 x 4 mm., 10 x 5 mm., 12 x 5 mm., 18 x 3 mm., 20 x 5 mm., and so on; margins rather waved; walls strongly corrugate. Corallites very long, tall (at least five inches, and then incomplete), parallel. Epitheca very regularly and coarsely striate. Corallite chains moderately farcimentiform, slightly undulating the margins of the fenestrules. Autopores large, long-oval, but without square or truncate ends, lateral margins rounded, two to nine in each corallite chain, four being the average number, from one to one and a quarter millimetres in length by three-quarters to one millimetre in breadth; visceral chambers transversely elongate (parallelogrammatic); tabulæ complete, horizontal or concave, variable in their distance apart, but usually half a millimetre. Gonopores very much larger than the mesopores, triangular, the sides either straight or concave, sometimes one of the angles truncate; walls as thick as those of the mesopores; visceral chambers nearly rectangular; tabulæ complete, horizontal, one-third millimetre apart. Mesopores transversely[2] elongate (parallelogrammatic), reduced to mere slits, or absent; visceral chambers longitudinally[3] elongate, very narrow; tabulæ complete, horizontal, one-quarter millimetre apart.

Obs.—This species is remarkable for the length and regularity of growth of its corallites, the constant and peculiar form of its gonopores, and the narrow and slit-like nature of the mesopores, when present. In its erect and compact manner of growth it resembles *H. cratus*, more than any other Australian species; but the relative sizes of the autopores will at once distinguish the two forms, to say nothing of the peculiarities of the other two sets of zooids just indicated.

When a corallum is viewed macroscopically from above, without relation to the mode of growth or length of corallites, *H. orthopteroides* might at first sight be mistaken for *H. Sussmilchi*, but the fenestrules are more labyrinthine than those of the latter; and what is of more importance,

[1] *ὀρθόπτερος*—"with high or upright columns," and *oides*—"resemblance."
[2] That is to say, at right angles to the direction of growth of a corallite chain.
[3] That is to say, parallel to the general growth of the corallum.

the farcimentiferous outline of the autopores is much less marked than in the latter. Furthermore, the alignment of the corallites in a chain is more continuous and unbroken in the present species than it is in *H. Sussmilchi*, as the mesopores do not occur in re-entrant spaces, although the alignment in *H. orthopteroides* is not so continuous as in *H. lithostrotonoides*.

The reduction of the mesopores to mere slits is not due to infilling, or thickening of the tissues, but is structural; the proportion of mesopores present or absent is about equal, and when these zooids are not present the autopores abut against one another, and are only separated by the intervening walls.

The regular triangular outline of the gonopores, and the frequent truncation of one of the angles, are very characteristic features in this species. The alignment of the corallite chain margins is more or less regular, like those of *H. lithostronoides*, and in consequence, those of *H. catenularius*, var. *gracilis* (Hall), Lambe.

Loc. and Horizon.—L. Smith's Station, Portion 98, Ph. Gamboola, Co. Wellington (*C. Cullen*).

Collection.—Mining and Geological Museum, Sydney.

Halysites Süssmilchi, *sp. nov.*

(Pl. III, Figs. 3 and 4; Pl. VII, Figs. 1–3.)

Sp. Char.—Corallum expanding sub-pyriform, the parent corallites sub-radiate from a common base, forming colonies up to seven and a half inches high by six inches wide. Fenestrules variable in size, and particularly in outline, round, oval, elongate, S-shaped, dumb-bell shaped, roughly polygonal, labyrinthine, or quite irregular, but, as a rule, one axis greatly exceeds the other; sizes 3 x 3 mm., 5 x 5 mm., 9 x 2 mm., 10 x 3 mm., 12 x 5 mm., 15 x 3 mm., and so on, up to 25 mm. in length; margins strongly undulate; walls coarsely and strongly corrugate or ribbed. Epitheca coarsely striate. Corallites long, at least four inches, and then imperfect. Corallite chains strongly farcimentiform. Autopores round or round-oval, from five to twenty-five in each corallite chain; length, one to one and a half millimetres by one in breadth; visceral chambers transversely elongate (parallelogrammatic); tabulæ well developed, complete, horizontal, half a millimetre apart. Gonopores well developed, triangular, quadrangular, or polygonal; tabulæ complete, horizontal, one-third of a millimetre apart; walls of equal thickness to those of the autopores. Mesopores well developed,

in long re-entrant spaces, rectangular and narrow transversely, half to one-third millimetres in longest diameter by half a millimetre in width, but by a rounding of the angles sometimes becoming oval, occasionally double; visceral chambers transversely oblong; tabulæ complete, close, horizontal, or oblique, one-quarter of a millimetre apart.

Obs.—*Halysites Süssmilchi* is so distinct from the other non-septate forms, that the points of divergence need hardly be referred to; however, the oval or round outline of the autopores and the re-entrant spaces occupied by the mesopores produce equally apparent undulating margins to the fenestrules, the mesopores separating the autopores by well-defined interspaces, a very different appearance to that noticeable in *H. lithostrotonoides*, &c. In a lateral view of a weathered corallum, the oval or round outline of the autopores conveys to the fenestrule walls a highly-ribbed or fluted appearance, producing on the whole much the aspect of a sheet of corrugated galvanised iron.

The labyrinthine or irregular outline of many of the fenestrules seems to be a prominent feature in this species; still, there is not the same rambling habit of growth as in *H. australis*, in which the fenestrules are equally irregular. Again, like the latter, *H. Süssmilchi* is one of the forms in which secondary silicification has been carried to the greatest extent. The outline of the autopores and deep re-entrant spaces between them containing the mesopores, resemble those of one of Nicholson's figures[1] of *H. catenularius*; similarly, there are no septa.

Loc. and Horizon.—Bed *d*, Spring Creek, Portion 221, Ph. Barton, Co. Ashburnham (*J. M. Curran* and *C. A. Süssmilch*).

Collections.—Australian Museum, and Technical College, Sydney.

Halysites cratus,[2] *sp. nov.*

(Pl. I, Figs. 2 and 3; Pl. IV, Figs. 3 and 4; Pl. VI, Figs. 5 and 6.)

Sp. Char.—Corallum massive, forming large tabular colonies of parallel and non-radiating corallites up to eight inches by five inches in size. Fenestrules large, as a rule longer than wide, some quadrangular, a few polygonal, but the geometric outline always obscure, the majority being curved, labyrinthine, or quite irregular in outline, and often almost linear; sizes 5 x 5 mm., 7 x 4 mm., 6 x 5 mm., 10 x 1 mm., 11 x 2 mm, 14 x 3 mm.; margins highly

[1] Nicholson, Tab. Corals Pal. Period, 1879, pl. x, f. 7.

[2] κρᾶτὺς—"robust."

undulate; walls strongly corrugate. Corallites very long, up to eight inches, parallel. Epitheca coarsely striate. Corallite chains highly farcimentiform, often contiguous laterally. Autopores very large, oval to circular, the latter forming a conspicuous feature; from one to six in each corallite chain, the average being four, from one and a half to two millimetres by one to one and a half millimetres in diameter, or at times possessing the same diameter in both directions; visceral chambers transversely elongate (parallelogrammatic); tabulæ complete, distant, and very regular, horizontal, or slightly concave, half to three-quarters of a millimetre apart. Gonopores quadrangular, polygonal, or variable in form, sometimes absent at the chain junctions, but when present, always much larger than the mesopores; walls as thick as those of the latter; visceral chambers nearly square; tabulæ complete, equidistant, horizontal, one-third of a millimetre apart. Mesopores numerous, in short but very marked re-entrant spaces, transversely elongate (parallelogrammatic), but not slit-like, half to three-quarters of a millimetre in longitudinal measurement by one-quarter to three-quarters of a millimetre transversely; visceral chambers longitudinally elongate (parallelogrammatic); tabulæ complete, horizontal, one-quarter millimetre apart.

Obs.—*H. cratus* is a strong and robust species, possessing the largest autopores of any of our *Halysites*, and by the almost circular outline of the latter is readily recognisable. As in *H. orthopteroides*, the corallite chains are very farcimentiform, but whereas the individuality of the autopores arises from the interpolation of long mesopores in the latter, in the present instance the re-entrant spaces containing the mesopores are short, and the sausage-like outline of the corallite chains sensibly increased thereby, and the rotundity of the autopores rendered very conspicuous.

The colonies form large tabular masses like those of *H. peristephesicus*, and possibly also *H. orthopteroides*, but exceeding both in the length of the corallites, and in consequence height of the corallum.

H. cratus is a most interesting species from the fact that many of the chains do not always take their origin from and junction with a gonopore at their opposite ends, but sometimes by the simple interposition of a mesopore. At the same time, gonopores are present both in numbers and normal position; and not only of large size, but in some instances surrounding the chief zooid are other smaller accessory tubes, producing a minute and limited cœnenchyma. When a corallite chain junctions with a mesopore, the latter only differs from the ordinary mesopores regularly interpolated between the

autopores by possessing a square outline. There is, however, this important fact, that if a corallite chain be found to unite with a mesopore at one end, it will be found to junction with a gonopore at the other; this seems to imply that its point of origin is, after all, a gonopore, and the junction of the mesopore is merely to form a re-union with another chain. I give this as a possible solution of the matter.

In a longitudinal section of a few corallites, the disproportion between the diameters of the autopores and mesopores becomes at once apparent. It is in marked contrast to that seen in *H. catenularius*, var. *amplitabulata*, Lambe.

The more important comparative features relied on for the specific separation of this coral are—(1) Large size and round outline of the autopores; (2) short re-entrant spaces between the autopores occupied by the mesopores; (3) marked difference in diameter between the autopores and mesopores; (4) long and almost linear outline of many of the fenestrules.

In the rotundity of the autopores, large size of the mesopores, and irregularly labyrinthine outline of the fenestrules, this species so far resembles one of Lambe's illustrations of *H. catenularius*, Linn.,[2] and *H. regularis*, Fischer-Benzon[3]; indeed, the whole aspect of the latter coral, in sections, is much like the Australian species. One of Počta's enlarged figures[4] of *H. catenularius*, Linn., represents the structure of the present coral very completely when examined in transverse sections.

Loc. and Horizon.—One mile west of Claudius Smith's Homestead, Ph. Copper Hill, Co. Wellington (*C. Cullen*); L. Smith's Station, Portion 98, Ph. Gamboola, Co. Wellington (*C. Cullen*).

Collection.—Mining and Geological Museum, Sydney.

B.—Spiniform Septa present.

Halysites australis, *Eth. fil.*

(Pl. VI, Fig. 4; Pl. VII, Fig. 6; Pl. IX, Figs. 1 and 2.)

Halysites australis, Eth. fil., Rec. Austr. Mus., III, Pt. 4, 1898, p. 78, Pl. XVII.

Sp. Char.—Corallum lax and spreading, or forming loosely constructed shrub-like growths, ultimately uniting with one another to form colonies ranging up to nine inches in height. Fenestrules very variable in form and

[1] Lambe, Contr. Canadian Pal., IV, Pt. 1, 1899, pl. iv, f. 4*a*.
[2] Lambe, *Ibid.*, pl. iii, f. 2, 2*a*.
[3] Fischer-Benzon, Abhandl. Gebiete Naturwis. Vereir Hamburg, V, 2 Abth., 187i, pl. ii, f. 1-3
[4] Počta, Barrande's Syst. Sil. Bohême, VIII (ii), 1902, pl. cii, f 4.

size, quadrangular, polygonal, often of irregular and rounded outline; sizes from 3 x 3 m. up to 15 x 15 m., with intermediate gradations; margins plain, in one alignment, non-fluctuating; walls flat, or with faint broad ribs or corrugations. Complete corallites unknown, but apparently of no great length. Epitheca with delicate, fine, transverse striation. Corallite chains simple, narrow, farcimentiform only in the smallest degree. Autopores oval to long oval, with rounded ends, two to twelve on each corallite chain, the average being from four to six, from three-quarters to one millimetre in longest diameter by half to three-quarters of a millimetre in width; walls very thick, solid, often presenting the appearance as if the zooids were sunk in them; septal spines well developed, long, from one to three cycles in each visceral chamber, according to the distance apart of the tabulæ, all but meeting at the calicinal centres; pseudo-columella not observed; visceral chambers transversely elongate (parallelogrammatic), very variable in longitudinal diameter; tabulæ complete, close or distant, horizontal or oblique, from three to six in the space of one millimetre vertical. Gonopores large and polygonal, here and there triangular, round, or irregular; walls as thick as those of the mesopores; tabulæ complete, horizontal, half a millimetre apart. Mesopores transversely oblong and narrow, the corallites pipe-like to quadrangular and large; visceral chambers longitudinally elongate as a general rule; tabulæ complete and equidistant, horizontal, half a millimetre apart.

Obs.—*H. australis* is of large and rambling growth, and very variable in some of its characters, particularly the distance apart of the autoporal tabulæ. A large specimen from Molong, in the Geological Survey Collection, indicates that it grew in arborescent bunches commencing from a number of centres of growth, the corallites of one bunch as they grew intermingling with those of another cluster; a colony of this description is nine inches by eight.

In my former description I stated that *H. australis* was devoid of spiniform septa, but by the acquisition of further specimens, and the preparation of a number of additional sections, I find that septal spines are present, but very variable in their development. Some specimens, although possessing all the other features of this species do not exhibit spiniform septa at all, in others they are visible only in the longitudinal sections, and again in a third set are more particularly noticeable in transverse sections. The spines are as usual twelve in a cycle, five springing from each autoporal wall, and one from each meso-autoporal wall, as figured by Fischer-Benzon in

his *H. regularis*,[1] and *H. escharoides*,[2] and by Nicholson again in the latter species.[3] They approximate closely to one another towards the calicinal centres, but in only one instance could I detect any union, and then only of two opposite spines without the formation of a longitudinal pseudo-columella. The number of cycles to a visceral chamber is also variable, one, two, or three, according to the distance apart of the tabulæ.

I also referred to the proximity to one another of the autoporal tabulæ, and the comparative distance apart of those in the mesopores. The latter statement holds good; but the former character in this species, like that of the spiniform septa, is open to much variation, even in the same corallite. The autoporal tabulæ may be quite close, from five to six in the space of one millimetre, or distant, three being contained in the same space. This, although in words a very trivial matter, is in reality an important feature, and presents in a section a most marked difference to that exhibited by the more numerous tabulæ. Another peculiarity is that patches or clusters of the closely-set tabulæ may appear in a group of corallites as the fundamental character of that particular series, and in consequence, several longitudinal sections are necessary, should the observer suspect he is examining a specimen of *H. australis*, before absolute certainty can be arrived at. Once this dual structure of the tabulæ in the autopores has been observed, the distinction I formerly drew between *H. australis* and other species still holds good.

Gonopores, as in *H. cratus*, are not invariably present at the junction of corallite chains, although the absence of this particular form of zooid from its normal position is not common.

The special points that appear to distinguish *H. australis* are—(1) rambling form of growth; (2) comparatively large size of the fenestrules; (3) thickness of the autoporal walls; (4) variability in the distance apart of the autoporal tabulæ; (5) pipe-like form of the mesopores in longitudinal section; (6) length of the spiniform septa, and their tendency to unite at the calicinal centres; (7) occurrence of a septal spine on each auto-mesoporal wall.

The lax and loose rambling habit of this coral is very like that depicted by Mr. R. Etheridge in his *H. catenularius*, var. *Harti*,[4] from the Arctic Regions. In fact, his remarks on the variety named apply equally well, so

[1] Fischer-Benzon, Abhandl. Gebiete Naturwis. Verein Hamburg, V, 2 Abth., 1871, pl. ii, f. 3.
[2] Fischer-Benzon, *Ibid.*, pl. iii, f. 2.
[3] Nicholson, Tab. Corals Pal. Period, 1879, pl. x, f. 6.
[4] Etheridge, Quart. Journ. Geol. Soc., 1878, XXXIV, p. 583, pl. xxviii, f. 2.

far as the external appearance is concerned, to *H. australis*. The growth and outline of the fenestrules is also that of *H. labyrinthica*, Goldf.[1] In the internal structure great similarity exists to that of *H. escharoides* (Lamk.), Fisher-Benzon,[2] and the coral so named by the latter author possesses both autopores and mesopores, as ours does, thus differing from Nicholson's conception of Lamarck's species.

Loc. and Horizon.—Bell River, on L. Smith's Station, Ph. Copper Hill, Co. Wellington, in alternating beds of shale and limestone, the upper beds with *Conchidium Knighti*, Sby. (*J. M. Curran* and *C. A. Süssmilch*); Ph. Copper Hill, Co. Wellington (*C. Cullen*); Suntop, Ponto-road, Ph. Ponto, Co. Lincoln (*C. Cullen*); Gourie, Ph. Guerie, Co. Lincoln (*C. Cullen*); Quedong (*Geol. Survey*).

Collections.—Australian, and Mining and Geological Museums, and Technical College, Sydney.

HALYSITES PYCNOBLASTOIDES,[3] *sp. nov.*

(Pl. IV, Figs. 1 and 2; Pl. VIII, Figs. 5 and 6.)

Sp. Char.—Corallum formed of large sub-pyriform masses consisting of slightly radiate corallites, producing colonies up to ten inches by six in size. Fenestrules round, oval, quadrangular, and polygonal, occasionally irregular, but seldom labyrinthine; sizes 2 x 2 mm., 3 x 2 mm., 4 x 2 mm., 5 x 1 mm., 7 x 2 mm., 10 x 1 mm., and so on; margins highly undulate; walls strongly corrugate or ribbed. Epitheca transversely striate. Corallites long, up to five inches (and then imperfect). Corallite chains strongly farcimentiform. Autopores very numerous, oval or round, one to five in a chain, the average two, one and a half millimetres in longest diameter by one millimetre in the opposite direction; septa confined to the autoporal walls only, and distinctly visible with the pocket-lens, arranged in from two to three cycles in each visceral chamber; the latter are transversely elongate (parallelogrammatic); tabulæ complete, horizontal, or at times oblique, about half a millimetre apart. Gonopores very numerous, greatly exceeding the mesopores in number, polygonal or irregular in outline, non-septate; walls as thick as those of the mesopores; visceral chambers transversely oblong (parallelogrammatic); tabulæ complete, horizontal, about one-fourth of a millimetre apart. Mesopores few in number in a corallite chain, but where present large and well developed in re-entrant spaces, and transversely elongate (parallelogrammatic) to quadrangular; visceral chambers nearly square; tabulæ complete, horizontal or rolling, about one-third millimetre apart.

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[1] Goldfuss, Petrefacta Germaniæ, 1826, pl. xxv, f. 5*a*.
[2] Fisher-Benzon, Abhandl. Gebeite Naturwis. Verein Hamburg, 1871, V, 2 Abth., pl. iii, f. 1–3.
[3] Πυκνόβλαστος—"full of buds," and *oides*—"resemblance."

Obs.—This is a compact and uniformly-grown coral, the corallites when seen in weathered specimens, transverse to the direction of growth, presenting to the naked eye a gemmuliferous appearance, arising from the great difference between the size and shape of the autopores and that of the mesopores, and the limited number of the latter; this resemblance is increased by the re-entrant spaces in which the mesopores are situated.

The limited number of corallites in a chain gives rise to an interesting point of structure, in that the gonopores predominate over the mesopores, so much so that it is very difficult to obtain a longitudinal section of one of the latter; when, however, this is accomplished, the diameter of the tubes, and distance apart of the tabulæ, will readily distinguish the mesopores.

No difficulty need occur in distinguishing *H. pycnoblastoides* from the highly farcimentiform non-septate *H. Süssmilchi*. The former is—(1) a much stronger and more robust species; (2) the fenestrules are constantly and uniformly larger, and with a diffierent outline; (3) the fenestrule walls are more strongly corrugate; (4) the autopores are oval in the former, round in the latter; (5) the re-entrant spaces containing the mesopores much more defined in the latter than in the former.

The first three points will also assist in distinguishing the present species from *H. orthopteroides*, as well as the form of the autopores in the latter, the triangular outline of the gonopores and slit-like mesopores.

The principal features to be noticed in *H. pycnoblastoides* are :—(1) the generally small size and non-angular outline of the fenestrules; (2) highly farcimentiform outline of the corallite chains; (3) plentitude of autopores, but the limited number in each chain; (4) copious development of gonopores; and (5) the less development of mesopores, and absence of septa projecting from their walls.

The outline of the autopores and the large square mesopores place this near *H. catenularius*, var. *nitida*, Lambe,[1] and the longitudinal sections of the two are by no means unlike either. On the other hand the dimensions of the respective parts do not agree.

Loc. and Horizon.—Bed *d*, Spring Creek, Portion 221, Ph. Barton, Co. Ashburnham (*J. M. Curran* and *C. A. Süssmilch*).

Collections.—Australian Museum and Technical College, Sydney.

[1] Lambe, Contrib. Canadian Pal., 1899, IV, Pt. 1, pl. iv, f. 2*a* and *b*.

Halysites peristephesicus,[1] *sp. nov.*

(Plate II ; Plate VIII, Figs. 1 and 2.)

Sp. Char.—Corallum forming large, thick, tabular masses up to two feet long, consisting of long parallel corallites ascending from an extended base of attachment. Fenestrules linear, labyrinthine, or convolute, often very long and clustered, or almost revolving around certain given centres; sizes 2 x 2 mm., 6 x 2 mm., 13 x 1 mm., 18 x 1 mm., 23 x 1 mm., &c.; margins very undulate; walls strongly corrugate or ribbed. Epitheca fine, transversely striate. Corallites long, straight, up to six and eight inches. Corallite chains varying from short to very long, the latter predominating, strongly farcimentiform. Autopores large, from two to twenty in a chain, but with no definite average number, broad oval in outline, with bulging sides, one millimetre, or slightly more in longest diameter, by three-quarters of a millimetre; septa short, in one or two cycles, not developed on the mesoporal walls; visceral chambers generally transversely elongate (parallelogrammatic); tabulæ complete, very regular, horizontal, or occasionally oblique, half a millimetre apart. Gonopores large, very irregularly polygonal, as a rule much longer in one direction than the other, non-septate; visceral chambers nearly square; tabulæ complete, horizontal, one-fifth of a millimetre apart. Mesopores well developed, transversely oblong, non-septate; tabulæ complete, horizontal, one-fourth of a millimetre apart.

Obs.—This is a large and very beautiful form of *Halysites*, and is remarkable for the length and linear appearance of its fenestrules, and so presenting a very marked contrast with *H. pycnoblastoides*. Mr. C. A. Süssmilch informs me that he saw a colony *in situ* which measured two feet long by five inches high and ten inches wide, and showed the extended flat-based tabular form to perfection. No other Australian *Halysites* that I have seen is of so compact a growth with similar long parallel corallites.

Another special feature in this species is the strange tendency the corallite chains seem to have of encircling, hardly revolving, round certain centres[2]; in fact, when viewed as a whole the corallum appears to be made up

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[1] Περιστεφής—"encircling an object."

[2] Since this description was written, I have seen Mr. R. P. Whitfield's interesting paper—"Observations on a remarkable specimen of Halysites," &c. (*Bull. American. Mus. Nat. Hist.*, 1903, XIX, p. 489), in which he describes a form referred to *H. catenulatus*, Linn., presenting on its upper side the original surface of the coral in about the condition it had while living in the "Silurian seas," and possessing on its upper surface seven "botryoidal or convex bosses" (*loc. cit.* pl. xli, pl. xlii, f. 5.) Mr. Whitfield further remarks on the elongation and compression of the "cell spaces" (our fenestrules) in the spaces between the "bossea." This is also noticeable in the corresponding spaces on the Australian specimens between what I have termed "rosettes" (Pl. ii, Fig. 3). On the other hand, the upward tooth-like extension of the cell walls seen in the American examples is not present, possibly on account of the state of preservation.

of a series of these "rosettes," as if the latter were separate centres of growth that had ultimately united, with here and there interspaces composed of chains assuming a more rambling form of growth. After all, this structure may be more imaginary than real, still such an appearance does exist. I have made use of this character for the specific name.

Certain appearances in one specimen of *H. peristephesicus* led me to hope that I had discovered traces of the base of attachment and commencement of growth of the corallum. Along the uneven base of this particular example is a well-marked line, or series of superimposed lines, of a dark colour on which all the corallites rest. This base is not actually flat and in one plane, but rolling as if accomodating itself to some surface or object of attachment. The examination of thin sections, however, taken along this line, ended in disappointment, for the dark line, or lines, appear to consist of organic material formed of the flocculent matter accompanying Endophytic Fungi, often previously referred to by me in connection with our Palæozoic Corals, and some amount of cellular tissue. I cannot detect any structure that could be construed into a commencement of growth.

Like *H. pycnoblastoides*, this species resembles *H. catenularius*, var. *nitida*, Lambe, in the outline of its autopores and mesopores, and also in the long rambling outline of the fenestrules, but the corallite chains are far too farcimentiform in both the species and variety named to be compared to those of *H. peristephesicus*.

Loc. and Horizon.—Bed *a*, Quarry Creek, Portion 222, Ph. Barton, Co. Ashburnham (*J. M. Curran* and *C. A. Süssmilch*).

Collections.—Australian Museum, and Technical College, Sydney.

Halysites gamboolicus,[1] *sp. nov.*

(Plate V, Figs. 1 and 2; Plate VI, Fig. 3.)

Sp. Char.—Corallum delicate, compact, formed of sub-pyriform to sub-hemispherical masses up to five inches by five inches in size. Fenestrules very irregular in outline small, on the whole, when compared with the other species of similar growth, non-geometric, no two alike, narrow or broad, elongate in either direction without being labyrinthine; sizes 3 x 2 mm., 4 x 2 mm., 5 x 5 mm., 6 x 4 mm., 10 x 3 mm., &c.; margins moderately undulate; walls not highly corrugate or ribbed. Epitheca very fine. Corallites long, slightly radiate.

[1] In allusion to the locality.

Corallite chains farcimentiform, delicately undulating the margins of the fenestrules. Autopores small, delicate, but well developed, oval but square-ended, from two to eight in a chain, the average four, three-quarters of a millimetre in longest diameter by three-quarters in a contrary direction; walls thick; septa confined to the autoporal walls, from two to three cycles in each visceral chamber; the latter transversely elongate (parallelogrammatic) to nearly square; tabulæ complete, distant, horizontal, concave, or now and then rolling, half a millimetre apart. Gonopores numerous, well developed, large, polygonal or irregular in outline, always larger than the mesopores, non-septate; visceral chambers transversely elongate (parallelogramatic); tabulæ complete, horizontal or oblique, one-quarter millimetre apart. Mesopores well developed and constant in position in re-entrant spaces, transversely elongate (parallelogrammatic), often double, or by removal of the central portion of the dividing wall horologiform; walls thick, but less so than those of the autopores; visceral chambers longitudinally elongate; tabulæ complete, horizontal, one-quarter of millimetre apart.

Obs.—This compact form is the most delicate of our *Halysites*, and although resembling *H. pycnoblastoides* in its general habit, is distinguished by its smaller autopores. When viewed macroscopically, the absence of a geometric outline to the fenestrules and the farcimentiform appearance of the corallite chains will at once separate *H. gamboolicus* from *H. lithostrotonoides*. It is interesting to meet with double mesopores in this species, similar to some of those figured by Fischer-Benzon in his *H. cavernosa*[1]; when the intervening central portion of the new wall dividing these mesopores is broken down, a regular hour-glass-shaped figure is the result. The longitudinal or vertical sections of the mesopores resemble those of *H. australis*.

Loc. and Horizon. — Portion 98, Ph. Gamboola, Co. Wellington (*C. Cullen*).

Collection.—Mining and Geological Museum.

Halysites chillagoensis,[2] *sp. nov.*

(Plate V, Figs. 3 and 4; Plate VIII, Fig. 3; Plate IX, Fig. 3.)

Obs.—This coral will be described in detail in one of the Reports of the Geological Survey of Queensland.

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[1] Fischer-Benzon, Abhandl. Gebiete Naturwis. Verein Hamburg, V, 2 Abth., 1871, pl. i, f. 2.
[2] In allusion to the locality.

I have seen only imperfect examples, but the interest attached to it is both of a morphological and geological nature. In some of its characters it approaches closely to those of *H. australis*, and I at one time regarded it merely as a variety of the latter. The entire absence of mesopores (so far as my observation has gone), and the absence of closely-clustered autoporal tabulæ, seem to set it apart; but, at the same time, I accord it specific rank with all reservation. The plan of growth of the colonies appears to be similar to that of *H. australis*, although the fenestrules are of a less rambling habit.

The absence of mesopores is quite apparent on examining longitudinal sections, the autopores abutting closely against one another, the tabulæ of contiguous tubes being either opposite or sub-opposite. The septa are by no means easy to distinguish. They are faintly discernible in a transverse section as short spines, and in the longitudinal as dark dots in the visceral chambers of the autopores, representing the cut ends of the spines projecting from the autoporal walls. The number of cycles appears to be inconstant—one cycle in one visceral chamber, two in others, and possibly three in a few instances.

If the constant absence of mesopores is a specific feature, the Queensland coral is certainly distinct from any of the foregoing. It is at the same time a feature of high morphological importance, for it proves what has been foreshadowed in some of the previous species that gemmation may proceed from autopore to autopore without the intervention of a mesopore.

The first indication of *Halysites* as a Queensland fossil is due to Mr. B. Dunstan, Acting Government Geologist of Queensland, who recorded[1] its occurrence near Mungana, Chillagoe Gold-field.

In 1900 I described[2] a *Halysites*, in a highly altered condition, from the Gordon Limestone at the Mersey River, between Liena and Mole Creeks, Tasmania, forwarded to me by Mr. T. Stephens, M.A., of Hobart. With the exception of two trivial characters, viz., the size and form of the fenestrules, and the presence of concave instead of generally horizontal autoporal tabulæ, the general structure does not appear to differ from that of *H. chillagoensis*. The form and size of the autopores is practically the same, there are the same thick and feebly corrugate lamellar walls, solid and trenchant intercorallite walls, and no mesopores, feeble gonopores, and these not always present (or obliterated?), and small septa. The general resemblance impresses me strongly.

[1] Dunstan.—Some Chillagoe Geological Notes—*Ann. Progress Report Geol. Survey Q'land for* 1900 (1901). p. 21.

[2] Etheridge, Junr., Proc. R. Soc. Tas. for 1898–99 (1900), p. 81.

VI.—DISTRIBUTION OF THE SPECIES IN LOCALITIES.

Species.	Bed *a*, Spring Creek, Barton.	Bed *d*, Spring Creek, Barton.	Bed *a*, Quarry Creek, Barton.	L. Smith's station, Gamboola.	*Conchidium Knighti* beds, Bell River, L. Smith's station, Copper Hill.	1 m. west of C. Smith's homestead, Copper Hill.	Suntop, Ponto-road.	Guerie.	Queelong.	Mungana, Chillagoe Gold-field, Queensland.	Gordon River Limestone, Liena and Mole Creeks, Mersey River, Tas.
Halysites australis	...	...	...	...	×	...	×	×	?	...	.....
,, chillagoensis	...	...	...	...	.....	...	...	...	...	×	?
,, cratus	...	...	...	...	.....	×	...	...	...	...	.....
,, gamboolicus	...	...	...	× ×	.....	...	...	...	...	...	.....
,, lithostrotonoides ...	×	×	...	..	.....	...	...	...	...	...	.....
,, orthopteroides	...	...	...	×	.....	...	...	...	...	...	.....
,, peristephesicus	...	...	×	...	.....	...	...	..	...	...	.....
,, pycnoblastoides.....	...	× ×	...	...	.....	...	...	...	...	...	.....
,, Sussmilchi	...	×	...	...	.....	...	...	...	...	...	.....

VII.—CONCLUSION.

My study of the Australian *Halysites* compels me to adopt at least one general conclusion. However satisfactorily Nicholson's deductions may suit the European species, they will not hold good for the Australian.

To repeat, Nicholson defined (1) a species with two forms of zooids, and no septal spines (*H. catenularius*, Linn.); and (2) a second species with one form of zooid only, but this provided with septal spines (*H. escharoides*, Lamk.).[1]

Amongst the Australian *Halysites* we find species (1) with both autopores and mesopores and no apparent septa (*H. lithostrotonoides*, *H. orthopteroides*, *H. Sussmilchi*, and *H. cratus*); (2) with both autopores and mesopores, and septal spines (*H. australis*, *H. pycnoblastoides*, *H. peristephesicus*, and *H. gamboolicus*). Possibly, a third group may be represented by the Queensland form (*H. chillagoensis*), in which mesopores seem to be absent.

[1] Nicholson's views received the support of Počta, as already explained.

VIII.—NOTE ON A EUROPEAN SPECIES.

FISCHER-BENZON described, under the name of *H. cavernosa*, a *Halysites* in which the tabulæ of the mesopores are incomplete and vesicular. Lambe also figured a Canadian *H. catenularius* (so called) with the mesoporal tabulæ arched, and to some extent vesicular also.

In the Australian Museum Collection is a European coral said to be from Holmestrand in Norway, and labelled *H. labyrinthica*, Goldf. Sections of this (Plate IX, Figs. 5 and 6), prepared for the microscope, exhibit all the characters shown in *H. cavernosa*, F.-B.—wide autopores with occasional incomplete tabulæ, narrow mesopores carrying arched and vesicular tabulæ in longitudinal section, and cellular mesopores in transverse section. In fact, whatever *H. cavernosa*, F.-B., may be, I am convinced this Norwegian coral is also. I am induced to refer to this matter simply in confirmation of some of Fischer-Benzon's observations. The mode of growth, outline, and size of the fenestrules, &c., are certainly those of *H. labyrinthica*, Goldf., and it is possible that the latter and *H. cavernosa* may be identical.

PLATES AND EXPLANATIONS.

THE negatives from which Plates I–V are reproduced, and the negatives of sections, represented in Plates VI–IX, were taken at the Australian Museum by Mr. H. Barnes, Junr., and Mr. Thomas Whitelegge, respectively. As now represented, Plates I–V were reproduced by Mr. A. E. Dyer, and Plates VI–IX lithographed by Mr. E. W. Minchin, at the Government Printing Office, Sydney, under the direction of Mr. W. A. Gullick, Government Printer.

PLATE I.

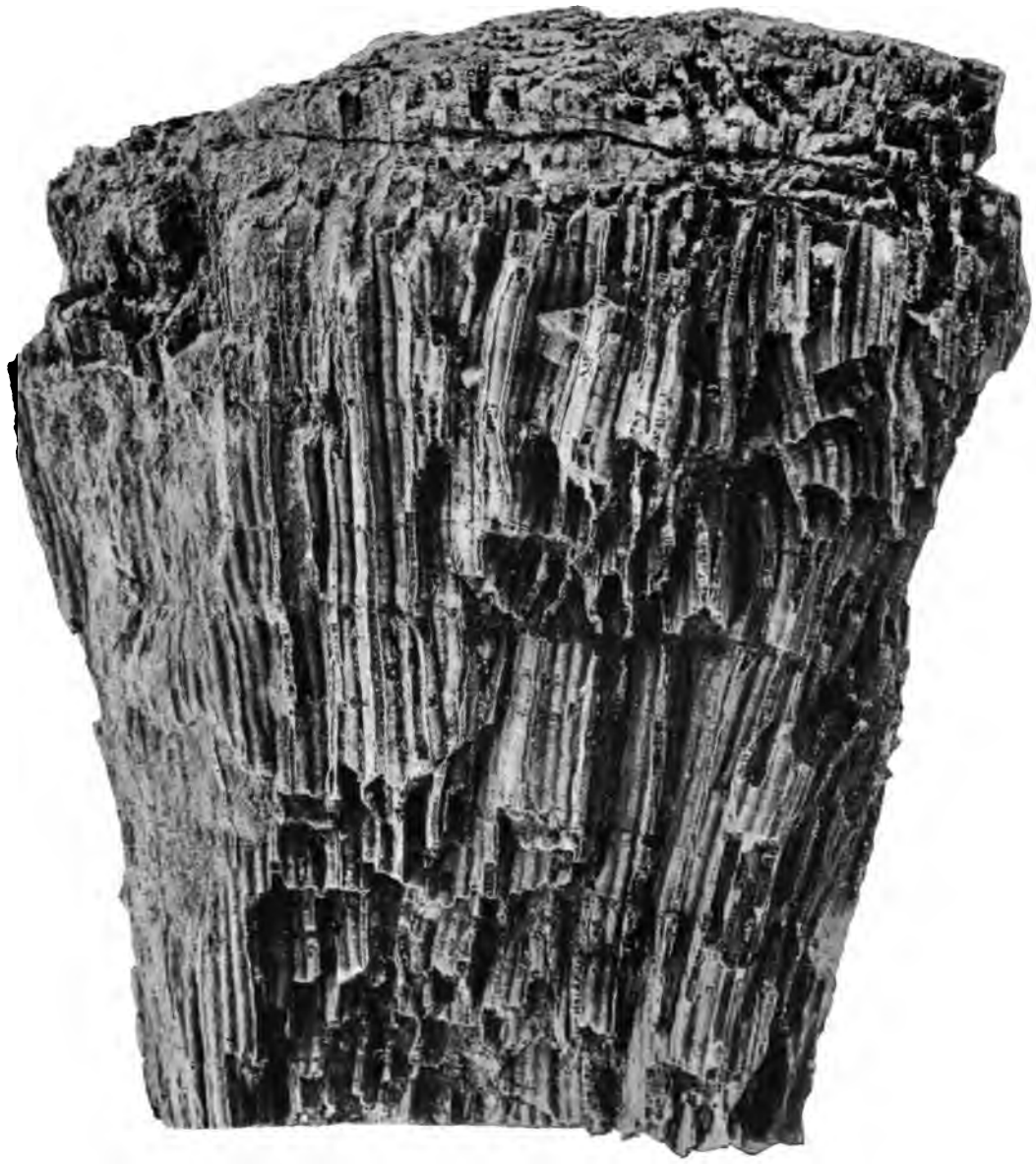
Halysites cratus, *Eth. fil.*

Fig. 1. A large corallum, longitudinal aspect, exhibiting the large autopores, gonopores, and mesopores.

Halysites lithostrotonoides, *Eth. fil.*

Fig. 2. Corallum seen from above, exhibiting the pavement-like form of the fenestrules.

Fig. 3. A larger corallum, longitudinal aspect, exhibiting the comparatively even sides of the fenestrules.



1

2

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H. Barnes, Junr., photo., Austr. Mus.

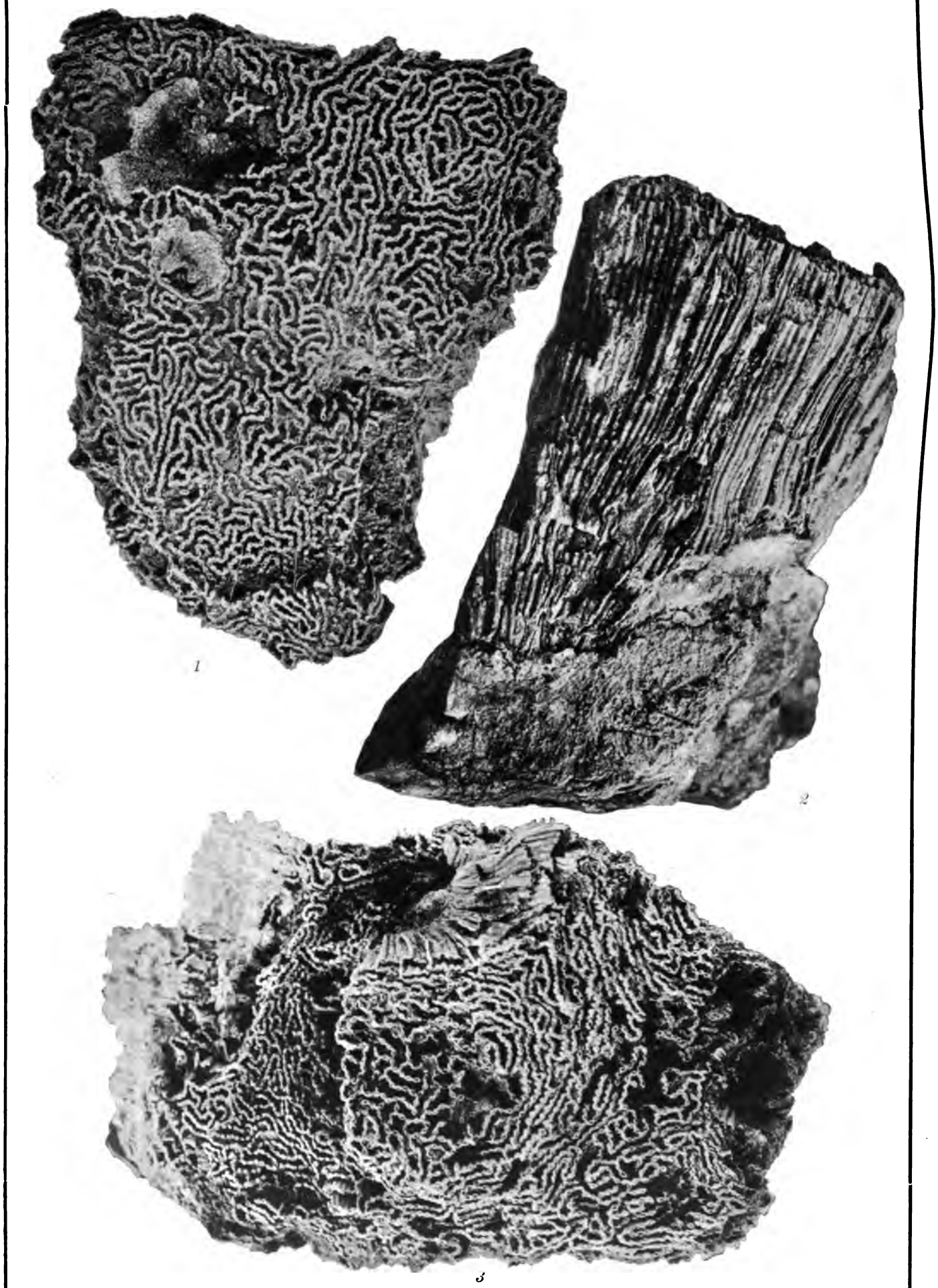
PLATE II.

Halysites peristephesicus, *Eth. fil.*

Fig. 1. Corallum seen from above, exhibiting the long, clustered, and labyrinthine fenestrules and corallite chains, more or less revolving around given centres.

Fig. 2. Portion of a corallum, longitudinal aspect, exhibiting the long corallites, and uneven base of the former.

Fig. 3. Another corallum, seen from above, exhibiting the apparent revolution of the corallite chains in a more marked manner than in Fig. 1.



H. Barnes, Junr., photo., Austr. Mus.

PLATE III.

Halysites orthopteroides, *Eth. fil.*

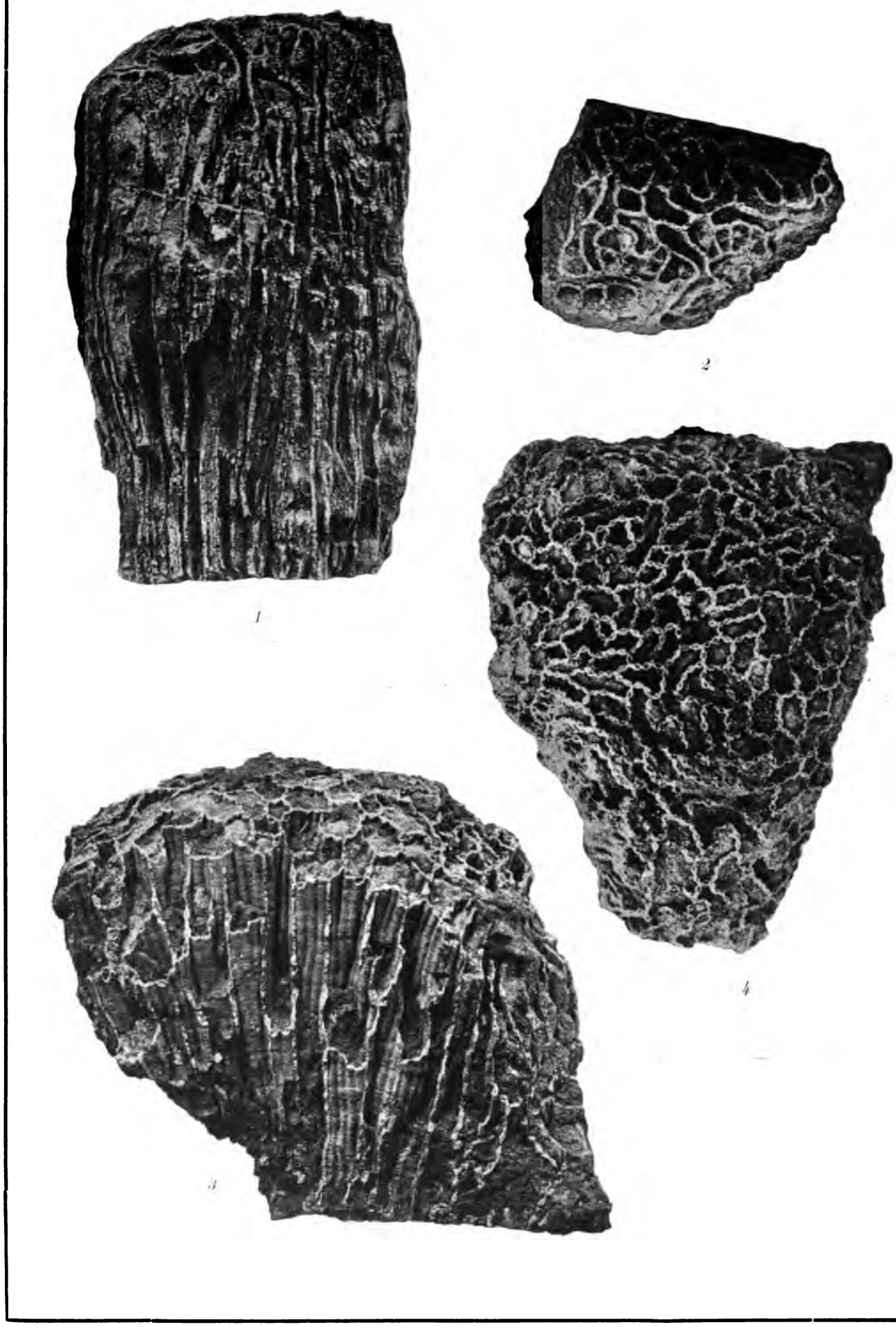
Fig. 1. Corallum seen in longitudinal aspect, exhibiting the long corallites and large fenestrules.

Fig. 2. Corallum seen from above, exhibiting long corallite chains and large fenestrules.

Halysites Sussmilchi, *Eth. fil.*

Fig. 3. Corallum seen in longitudinal aspect, exhibiting the large size and highly farcimentiform outline of the autopores, and hence the corrugated surface of the fenestrule laminæ.

Fig. 4. The corallum seen from above displaying similar characters.



H. Barnes, Junr., photo., Austr. Mus.

PLATE IV.

Halysites pycnoblastoides, *Eth. fil.*

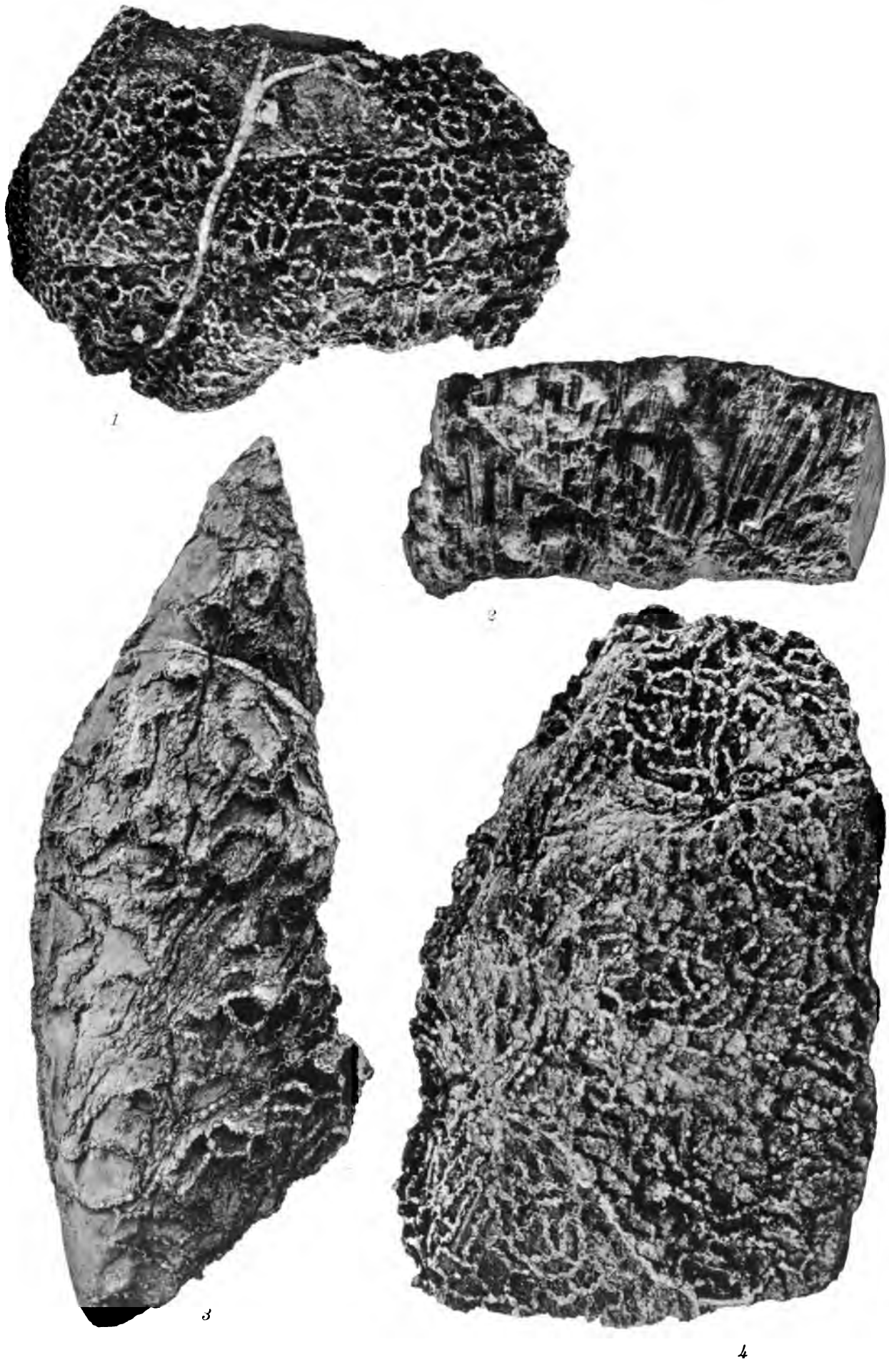
Fig. 1. Corallum seen from above, exhibiting the highly farcimentiform outline of the corallite chains, and gemmuliferous appearance of the autopores, and limited number of the latter in any given chain.

Fig. 2. Corallum seen in longitudinal aspect.

Halysites cratus, *Eth. fil.*

Fig. 3. An irregularly grown corallum, seen from above, with very large fenestrules.

Fig. 4. Corallum seen from above, exhibiting labyrinthine and somewhat crowded fenestrules, highly farcimentiform corallite chains, and large autopores.



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H. Barnes, Junr., photo., Austr. Mus.

PLATE V.

Halysites gamboolicus, *Eth. fil.*

Fig. 1. Pyriform corallum seen from above, exhibiting the dissimilar form of the fenestrules, and small autopores.

Fig. 2. Sub-hemispherical corallum seen from above obliquely.

Halysites chillagoensis, *Eth. fil.*

Fig. 3. Portion of a corallum seen from above.

Fig. 4. Portion of a corallum viewed longitudinally, and to some extent from above also.

H. Barnes, Junr., photo., Austr. Mus.

PLATE VI.

Halysites lithostrotonoides, *Eth. fil.*

Fig. 1. Transverse section exhibiting the form of the fenestrules; an incomplete chain; long regular autopores with narrow mesopores between them, and polygonal gonopores.—x 10.

Fig. 2. Longitudinal section showing the visceral chambers and tabulæ of autopores and mesopores, and those of a gonopore. The tube on the extreme upper right is a gonopore.—x 9.

Halysites gamboolicus, *Eth. fil.*

Fig 3. Transverse section exhibiting the form of the fenestrules; length of the corallite chains; long-oval autopores with thick walls, and septal-spines; transversely elongate mesopores, and polygonal gonopores.—x 9.

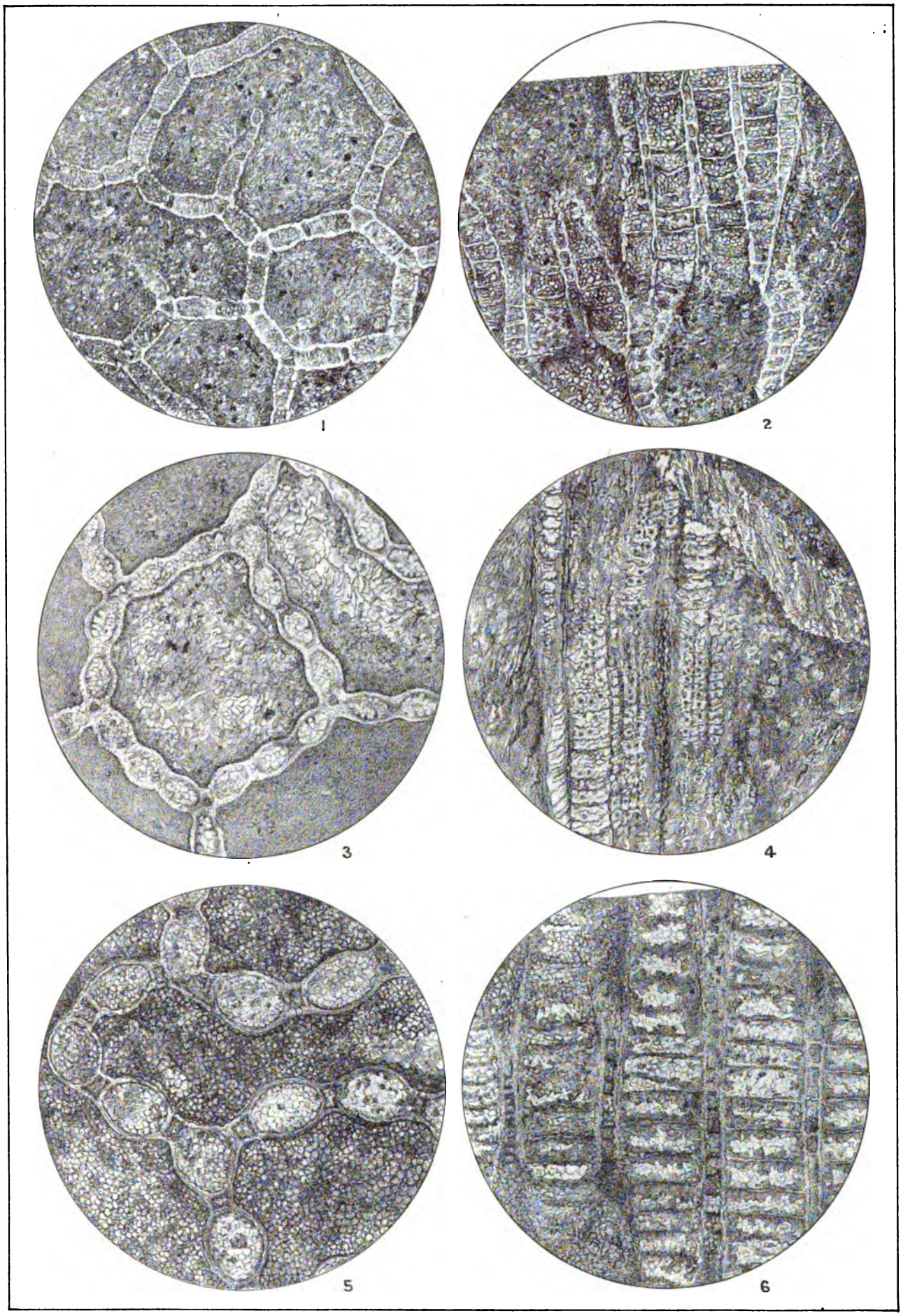
Halysites australis, *Eth. fil.*

Fig. 4. Longitudinal section exhibiting the autopores with numerous cut septal spines, and narrow pipe-like mesopores.—x 8. The specimen from which this section is prepared is in a highly altered condition: a far better illustration will be found in Pl. VII, Fig. 6.

Halysites cratus, *Eth. fil.*

Fig. 5. Transverse section showing the labyrinthine fenestrules; strongly farcimentiform corallite chains; large oval autopores; and large mesopores in marked re-entrant spaces.—x 8.

Fig. 6. Longitudinal section exhibiting the visceral chambers and regular horizontal tabulæ of the autopores; distant tabulæ of the mesopores, and those of a gonopore on the extreme right, between two autcpores.—x 8.



Lithographed by W. A. Gullick, Government Printer.

PLATE VII.

Halysites Sussmilchi, *Eth. fil.*

Fig. 1. Transverse section showing the fenestrules with strongly undulate margins, and highly farcimentiform corallite chains; round-oval autopores; mesopores in long re-ehtrant spaces; and large polygonal gonopores.—x 7.

Fig. 2. Another transverse section, with imperfectly formed fenestrules, and disunited and new corallite chains.—x 8.

Fig. 3. Longitudinal section, displaying the autopores with low wide visceral chambers and more or less horizontal tabulæ; a mesopore at the left centre, and a gonopore at the right centre.—x 8.

Halysites orthopteroides, *Eth. fil.*

Fig. 4. Transverse section showing the labyrinthine fenestrules; slightly undulate margins of the corallite chains; long oval autopores, separated by mere slit-like mesopores placed in very shallow re-entrant spaces.—x 8.

Fig. 5. Longitudinal section displaying the wide autopores, with their concave tabulæ; and narrow pipe-like mesopores. On the extreme upper right-hand is a gonopore wedged between two autopores.—x 8.

Halysites australis, *Eth. fil.*

Fig. 6. Longitudinal section exhibiting wide autopores with numerous cut-ends of septal spines; and narrow pipe-like mesopores with distant tabulæ.—x 8.

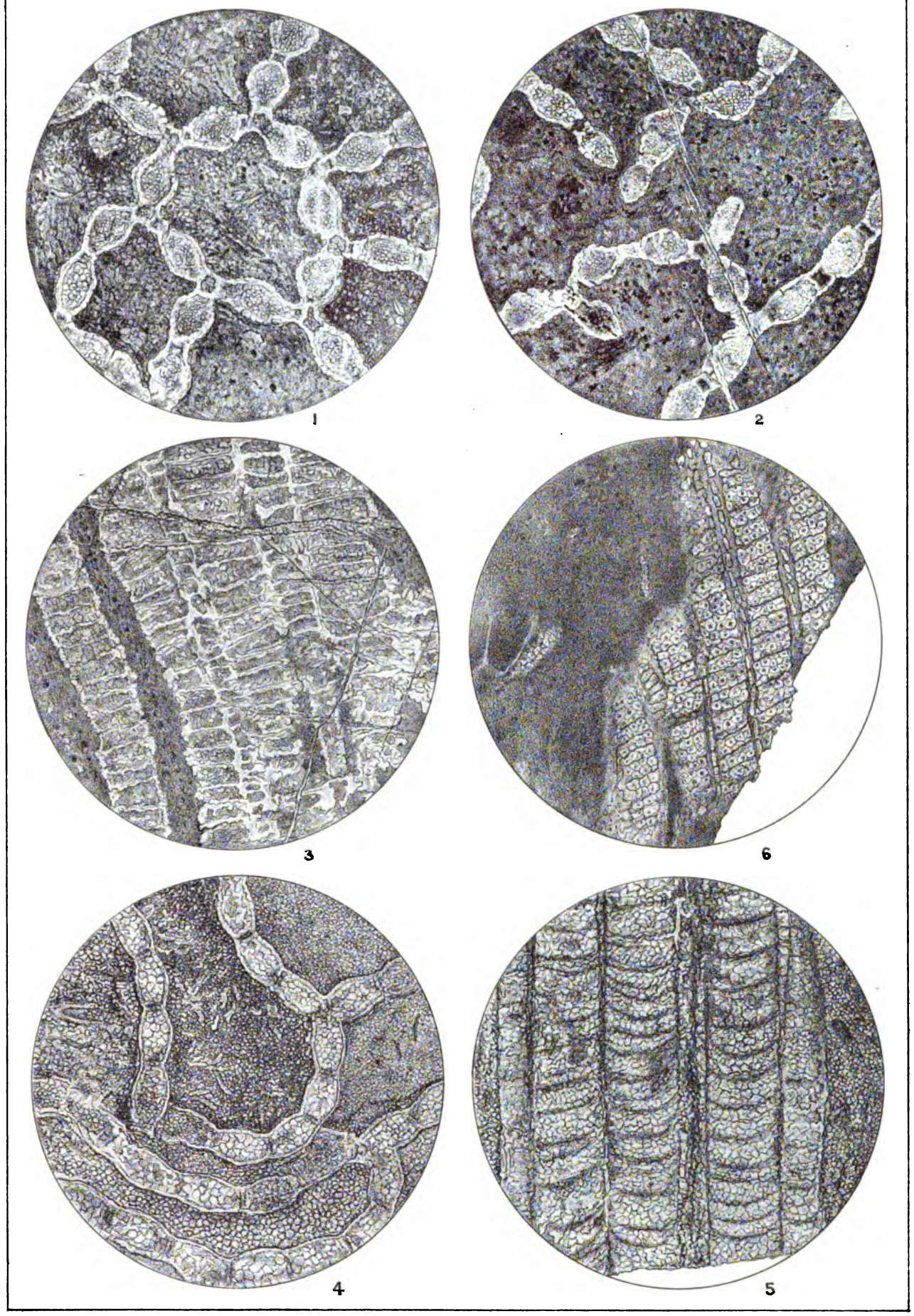


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PLATE VIII.

Halysites peristephesicus, *Eth. fil.*

Fig. 1. Transverse section showing labyrinthine linear fenestrules, with highly undulate margins of the corallite chains; large broad-oval autopores with septa and bulging sides, separated by transversely oblong mesopores placed in deep re-entrant spaces.—x 9.

Fig. 2. Longitudinal section displaying the moderately wide autopores with regular distant tabulæ.—x 9.

Halysites chillagoensis, *Eth. fil.*

Fig. 3. Section of a corallum, cut both transversely and somewhat obliquely, in a poor state of preservation, but exhibiting the less rambling form of the fenestrules, the form of the autopores, and absence of mesopores.—x 8.

Fig. 4. Longitudinal section displaying tabulæ in the autopores.—x 10.

Halysites pycnoblastoides, *Eth. fil.*

Fig. 5. Transverse section displaying strongly farcimentiform corallite chains; oval or nearly round septate autopores; large and irregular gonopores; and large transversely elongate mesopores.—x 8.

Fig. 9. Longitudinal section exhibiting wide and regularly tabulate autopores, with two cycles of septa in each visceral chamber, and a non-septate gonopore between two autopores.—x 8.

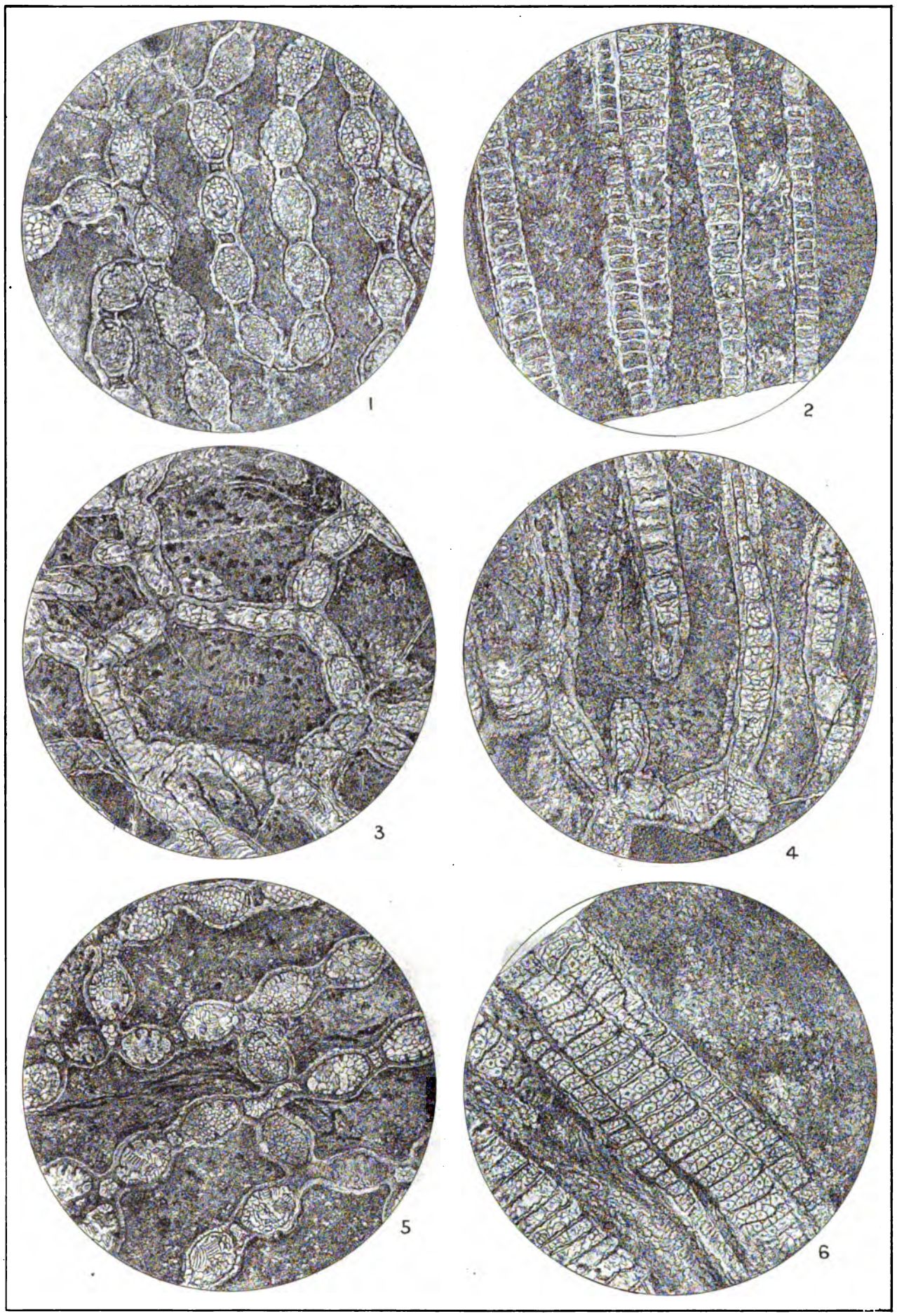

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PLATE IX.

Halysites australis, *Eth. fil.*

Fig. 1. Transverse section with a pentagonal fenestrule; slightly undulated corallite chains; immersed appearance of the long-oval septate autopores, and well-marked mesopores.—x 8.

Fig. 2. Transverse section of a fragment showing a peculiar form of cellular growth occupying a fenestrule.—x 8.

Halysites chillagoensis, *Eth. fil.*

Fig. 3. Portion of a naturally weathered specimen.—x $\frac{1}{4}$.

Halysites lithostrotonoides, *Eth. fil.*

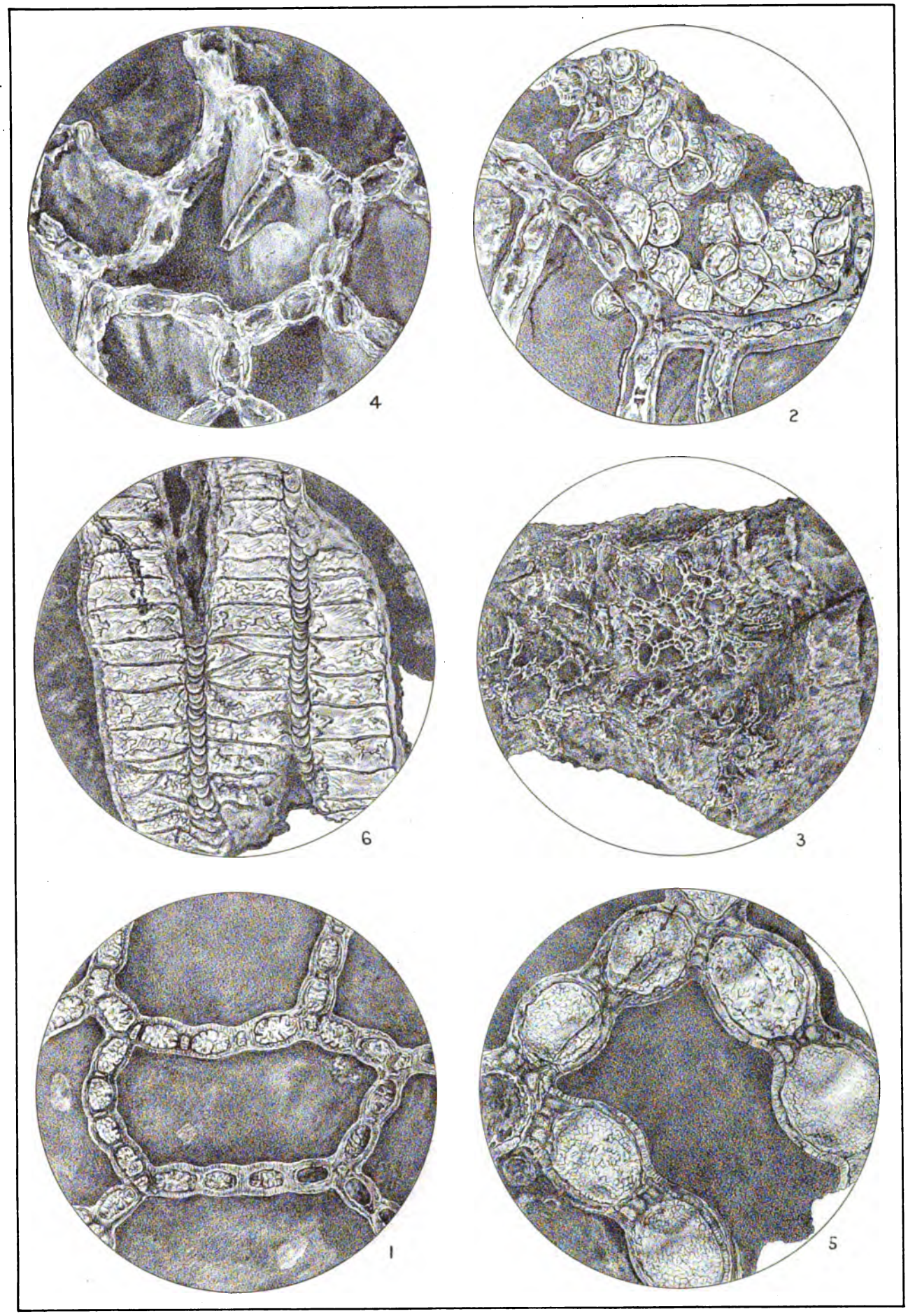
Fig. 4. Portion of a naturally weathered corallum exhibiting a fenestrule partially bisected by an incomplete corallite chain.—x 8.

Halysites sp.

(? H. labyrinthica, *Goldf.*, and H. cavernosa, *F.-B.*)

Fig. 5. Transverse section exhibiting very large round autopores, and cellular mesopores; the corallite chains are highly farcimentiform.—x 8.

Fig. 6. Longitudinal section displaying the very large autopores, with both complete and incomplete tabulæ; and the mesopores with arched tabulæ.—x 8.



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No. 6. Descriptions of the Palæozoic Fossils of New South Wales. By the late L. G. de Koninck, M.D. Pp. xiv, 298, 24 plates (4to., Sydney, 1898). Translated by Professor T. W. E. David, B.A., F.G.S., Mrs. David, and W. S. Dun.

No. 7. The Mesozoic and Tertiary Insects of New South Wales, pp. 12, 2 plates (4to., Sydney, 1890). By R. Etheridge, Junr., and A. Sidney Olliff.

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No. 9. The Fossil Fishes of the Talbragar Beds (Jurassic?), pp. xiii, 31, map, sections, and 6 plates (4to., Sydney, 1895.) By Arthur Smith Woodward, F.G.S., &c.

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No. 13. A Monograph of the Silurian and Devonian Corals of New South Wales, &c., Part I. The Genus Halydites, pp. ix, 39, and 9 plates (4to., Sydney, 1904). By R. Etheridge, Junr.

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PALÆONTOLOGICAL SERIES.

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